Medical Lib.

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PROCEEDINGS

OF THE

ROYAL SOCIETY OF MEDICINE

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Section for the Study of Disease in Children.

President—Dr. J. D. ROLLESTON.

Three Cases of Bronchiectasis.

By W. P. H. SHELDON, M.D.Lond. (for HUGH THURSFIELD, M.D.).

Case I.—Patient, a girl, aged 11 years. History of pneumonia when 4 years old, with cough and debility since then. Admitted to hospital in January, 1926, with physical signs of fibrosis and bronchiectasis of the lower lobe of the left lung. Heart displaced towards the left side; well marked clubbing of the fingers. Sputum purulent and offensive, averaging 3½ oz. daily.

Treated for two months in the Trendelenburg position, during which time the sputum decreased to an average of 1½ drachms daily.

Returned to hospital in September, 1926, with physical signs unchanged, and the daily amount of sputum averaging 2 oz.

X-ray shows opacity of left base with displacement to the left of the heart shadow.

Case II.—Patient, a boy, aged 5½ years. Illness dated from attack of broncho-pneumonia four and a half years ago. At present heart displaced to right; marked impairment of percussion note over right lung, with loud bronchial breathing at angle of right scapula. Fingers slightly clubbed. Sputum non-offensive; amount averages 2 drachms daily.

X-ray shows considerable opacity of right lung with displacement of mediastinum to the right.

Case III.—Patient, a girl, aged 10 years. Has been ailing for six years, and at times has had abundant sputum. There is now impairment of movement of the right side of the chest, and poor air entry into the right base. Sputum averages 2 drachms daily in amount, and is not particularly offensive.

X-ray shows slight fibrosis at both pulmonary bases.

Discussion.—Dr. W. P. H. SHELDON said that these cases had been brought before the Section in order to obtain the views of the Members as to the most suitable treatment to be adopted, and especially as to whether any methods of surgical interference were indicated.

Dr. DONALD PATERSON said that his impression was that these cases usually did extraordinarily well; therefore, unless under ordinary treatment the patient went steadily downhill, he did not think it was wise to interfere surgically. Artificial pneumothorax would be very difficult in such cases as these because of the morbid anatomy.

Dr. HUGH THURSFIELD said he agreed with Dr. Paterson that most children with this condition got well, at least, for a time, but that the question of school life had to be considered. They were much handicapped in their education by constantly breaking down in the winter. If improvement in their condition could be brought about, sufficient for them to attend even a special school, it was worth the trouble being taken to effect this.

Dr. J. D. ROLLESTON (President) asked whether any Members would comment on lipiodol, from the therapeutic or the diagnostic point of view. Several cases in which it was used had been reported from Paris.

Dr. A. P. CAWADIAS said that upon comparing the frequency and severity of cases of bronchiectasis in England with the same conditions as in France, he had been struck by the fact that bronchiectasis was more frequent and more severe in England. In France these bronchial affections were for the most part treated medically on account of their mildness, and on account of the possibility of their climatic treatment in the South of France. Lipiodol was only used in a few hospitals for demonstration purposes, and as regarded pneumo-

thorax, his impression was that in the few cases of children with bronchial dilatation in which it had been applied the results were far from satisfactory, perhaps on account of the difficulties in the application of this mode of treatment in children. Simple medical treatment with inhalations, sojourn in mild climates, &c., gave far better results.

Dr. F. PARKES WEBER said that in a case known to him a physician carried out the operation of artificial pneumothorax for fœtid bronchiectasis, and a fœtid empyema resulted: but the patient had been running a high temperature at the time, and the case was altogether a desperate one.

A Child Recovering from Aphasia and Right-sided Hemiplegia: Attacks of Jacksonian Epilepsy on the Right Side.

By F. PARKES WEBER, M.D.

THE patient, C. A., aged 4½ years, a well-built English boy, is said to have fallen ill about January 25, 1926, and to have been feverish for about four weeks. According to the mother's account he then suddenly became unconscious and had short convulsive attacks on the right side—about one attack every quarter of an hour during forty-eight hours; these attacks were apparently accompanied by some opisthotonos. After forty-eight hours the attacks ceased, but the boy had lost the power of speech, and could not walk or use his right arm properly. In a few days he could walk again, but the loss of speech and stiffness in the right arm persisted. Before the illness (according to the mother) he could speak fluently.

When admitted to hospital under my care on March 17, 1926, there was almost complete aphasia, together with slight spastic paralysis in the right upper extremity. The gait was almost, if not quite, natural. There was no facial paralysis. Ophthalmoscopic examination (Dr. C. Markus) showed nothing abnormal. The urine was free from albumin and sugar, and there was no sign of any disease in the thoracic or abdominal viscera. The boy was active and apparently of normal intelligence.

According to the mother he was born prematurely (seventh month) and was her second child. She had had three children; no miscarriages. The eldest one died in infancy. The third one, born at full term, was living and healthy, aged 2 years. There was nothing special to be noted in the family history, excepting that the patient's maternal grandfather, now aged 57 years, used to drink heavily and has always been subject to attacks of passion. His father (the patient's great-grandfather) is said to have been similarly passionate, though he was a teetotaller.

When I saw the boy in May (in the out-patient department) he was obviously gradually learning to speak again. He could say "yes," "no," "daddy," "mummy," "Teddy" (the name of a little boy friend of his), "but-but" (when he wanted bread and butter), but when he wanted anything he would usually point to it and make a kind of grunting sound; so also when he wanted to go to the water-closet, he would point to it and grunt. He took an intelligent interest in everything, was very shy with strangers, and showed great affection towards his mother. He could walk and run normally, but was still awkward and relatively weak with his right hand. In regard to the lower extremities he seemed normal; there was no difference between them in movements or reflexes.

When I saw the boy on July 14 he looked well and fresh, fairly attentive and intelligent, and was making great progress in learning to speak. He had added many words to his vocabulary, but his pronunciation of some of them was very imperfect. There was not the slightest stammering; nor was there any tendency to so-called "idioglossia," such as has been noted in some children as a result of a cerebral defect or delay in development. The boy's mother was, however, anxious, because on a

recent morning, about 5 a.m., she had observed convulsive twitchings on the right side, lasting about two minutes, and associated, according to the mother, with a curious appearance about the eyes; for a short time after this convulsive attack the boy seemed dazed or not quite natural.

On July 26 he was re-admitted to hospital for further observation, as, according to his mother, he had had several further transient convulsive attacks of the same character, apparently resembling very slight Jacksonian epilepsy on the right side. He remained in hospital till August 5, but during that time "no attacks" of any kind were observed. The boy was learning to speak better. He was, however, obviously left-handed and preferred to use his left hand for eating, for picking up or throwing a ball, or for making marks with a pencil. The mother thought the boy's character had altered somewhat since his illness and that he hung to her more, begging to sleep in the same bed, &c.

On October 14, when I saw the boy again, there was still an appearance of awkwardness in the right hand; he could speak better, but the mother said he had often had transient convulsive fits, involving the right limbs, and once or twice (very rarely) associated with real unconsciousness. He sometimes would let his mother know when a "fit" was coming on, by calling out "mum" or making a grunting sound to attract her attention; on one occasion the attack seemed to be preceded by pain in the right upper limb; this pain was complained of just before the attack came on.

REMARKS.

It seems as if the original illness in this case was an encephalitis of the nature of "Heine-Medin disease," a cerebral variety of infantile paralysis, that is to say, an encephalitic, right-sided, spastic hemiplegia (hemiparesis) with aphasia (presumably of the ordinary so-called "motor" kind), in which, excepting for slight awkwardness in the position and movements of the right hand and the resulting left-handedness, the hemiplegia has been completely recovered from, and the aphasia is being gradually recovered from. During the healing process the lesion on the left side of the brain, which at first caused right hemiplegia or hemiparesis, has given rise to a cicatrix or some defect, sufficient to act as a "spasmogenic focus" and produce occasional transient convulsive attacks of the nature of slight right-sided Jacksonian epilepsy. The attacks have been much lessened by small doses of potassium bromide.

The aphasia in this case, associated as it was with right-sided cerebral hemiplegia, is probably of the so-called "motor aphasia type," and cases of the kind at so early an age as four years must be of great rarity. The condition should be contrasted with cases of "word-blindness" and "word-deafness" in children.[1] In regard to the resulting slight epileptiform seizures (type of "Jacksonian epilepsy") the case may be compared, for instance, with one shown by Dr. C. O. Hawthorne,[2] but in that case (a boy, aged 8 years) there was no mention of any aphasia.

Discussion.—Dr. NEILL HOBHOUSE said that there were several points about this case which were unusual; the occurrence of aphasia was uncommon, and the site of the lesion was not easy to determine. Jacksonian epilepsy was, especially in a child, suggestive of a cortical origin, but here the extent of the hemiplegia rendered that unlikely. What had struck him particularly was the very small extent of the spasm, and he asked whether there had ever been a very severe degree of spasm. Usually good results were obtained in the treatment of that sort of case, so far as the return of power was concerned; the great difficulty was the

[1] Cf. F. Parkes Weber, "Congenital Word- and Letter-Blindness," *Brit. Journ. Child. Dis.*, London, 1917, xiv, pp. 183-188. In this paper I have referred to the observations of J. Hinshelwood and others on the subject, and on the kindred subject of word-deafness in children.

[2] C. O. Hawthorne, "Infantile Hemiplegia with almost Complete Recovery," *Reports of the Society for the Study of Disease in Children*, London, 1906, vi, p. 149.

4 Weber: *Right-sided Hemiplegia;* Doyne: *Facial Asymmetry*

spasm. The most difficult to treat was spasm of the pronator, but that seemed to have done very well in this case. The fact of the spasm being so slight was rather against the view that there was a lesion in the internal capsule or the corona radiata. This was one of the best results in hemiplegia he had ever seen.

Dr. J. D. ROLLESTON (President) emphasized the rarity of hemiplegia and aphasia as sequelæ of the acute infectious diseases, of which polio-encephalitis was an example. During the twenty-five years he had been occupied with infectious diseases he had seen very few cases of hemiplegia develop. It was now more than eighteen years since he saw a case of hemiplegia following scarlet fever, and he then[1] published three cases of hemiplegia following scarlet fever. Since then he had not seen a case of it. He had never seen hemiplegia following measles, though one would think, from the text-books, that it was an almost everyday occurrence. The experience of the late Dr. Claude Ker, of Edinburgh, was similar, namely, that nervous complications following measles were not common. He (the speaker) had seen only one case of hemiplegia in typhoid fever, and that was not in a fever hospital, but at a meeting of the Clinical Section of this Society.[2] The acute infectious disease most commonly followed by hemiplegia was diphtheria, but even in that disease hemiplegia was uncommon. At a meeting of this Section which was held at the National Hospital for the Paralysed, Queen Square, a case of the kind was reported,[3] but such were quite exceptional

With regard to aphasia occurring in a small child, French writers[4] had drawn attention to the comparative frequency of aphasia occurring in typhoid fever, and that might be a ground for regarding the indefinite preceding illness in the present case as typhoid.

Facial Asymmetry.

By P. G. DOYNE, F.R.C.S.

W. W., MALE, aged 11 years. First seen at St. Thomas's Hospital, in the Eye Department, January 25, 1926. Marked facial asymmetry. Right eye at a lower level than left eye. There appears to be much bony overgrowth of the right frontal region.

Eye movements normal. No diplopia. Vision in right eye $\frac{6}{12}$, with correction $\frac{6}{9}$; in left eye $\frac{6}{6}$. Fundi normal.

The mother has noticed the condition since birth, but thinks it is getting more noticeable lately.

X-ray report, January, 1926: "Apparent lack of development of right side, with very marked thickening of right frontal area of skull, extending back to pituitary fossa which is small and bridged. Does not give appearance of true tumour."

Mr. Howarth reports that there is no intranasal evidence of frontal sinus trouble.

Discussion.—Dr. HUGH THURSFIELD said he regarded this boy's condition as a more marked example of what, in smaller degrees, was a very common congenital defect, pre-natal, nothing to do with moulding of the head at birth known as "oblique-head." The shape of the skull was fairly characteristic; there was a flattening of one frontal eminence, usually the left, and a flattening of one occipito-parietal prominence, usually the right. Similarly, there was a prominence on the right frontal and a prominence on the left occipito-parietal area. So the axis of the head, instead of running straight through from front to back, ran obliquely. The tendency in all the patients whose later history he had been able to follow had been for the abnormality to disappear gradually, so that by the age of puberty the children, who were most remarkable objects in their earlier years, had lost their asymmetry, except that the two eyes never quite reached the same level. The reason

[1] *Rev. Neur. and Psych.*, 1908, vi, p. 530.
[2] A. F. Hertz, *Proc. Roy. Soc. Med.*, 1912-13, vi (Clin. Sect.), p. 63.
[3] R. Ironside, *Proc. Roy. Soc. Med.*, 1925, xix (Sect. Study Dis. Child.), p. 3.
[4] Hutinel et Darré in "Maladies des Enfants" (Hutinel), 1909, i, p. 656.

of that, he thought, was the flattening of the orbital plate on the left side. He had never seen such a case in which the eye was damaged or the sight was involved. Still he supposed that if there were a sufficiently severe twist of bones there might be such an alteration of the base of the skull as to involve the optic tract. In the case of the present patient, he believed that in a few years' time Mr. Doyne would not be able to recognize that the boy had ever had much the matter with him.

Dr. A. A. MONCRIEFF asked what was the significance of the great thickness of the skull in this case. The skiagram showed an extraordinary thickening of the vault of the skull, perhaps $\frac{1}{2}$ in. He asked whether this had been present also in Dr. Thursfield's cases.

Dr. THURSFIELD (in reply to Dr. Moncrieff) said that Dr. Moncrieff had, he thought, forgotten that the axis of the head was altered, and so also was the axis through which the X-rays passed.

Dr. S. P. HUGGINS said he agreed that one constantly saw some asymmetry of the head in small infants due to moulding during labour, which was evident when one looked down on the skull from above. This persisted in very many cases all through life, as could be shown by careful measurements. What he had not noticed at all frequently was asymmetry of the level of the eyes. Had Dr. Thursfield included the former type in the cases he mentioned?

Dr. DONALD PATERSON maintained that asymmetry was, in many cases, due to a tearing of the tentorium during the act of birth. A tear of the tentorium, which ran in all planes, would allow the head to sink in one place, and there would be a flattening out of the opposite side. It was known that the asymmetry corrected itself, but the condition which was so corrected differed from the case now shown. The condition of this patient was a very grave one, especially at 11 years; it was very optimistic to think the head would take on a normal shape. It was rare to see a grossly asymmetrical head after the age of about 2 years.

Dr. A. P. CAWADIAS said that lesser degrees of this asymmetry were very frequent. In the Paris Hospice de Bicêtre, in which there was a special section set apart for children epileptics, the great majority of the children had such asymmetry to some extent; this was a stigma of degeneration.

Dr. E. CAUTLEY said that this type of deformity was distinctly uncommon. He thought there was definite hyperostosis of the supra-orbital ridge on the affected side, in comparison with the other. It was a congenital hyperplasia of bone on that side.

Dr. T. BRUSHFIELD said that during twelve years he had been seeing cases with gross asymmetry of the face. He did not know definitely to what it was due. But in three or four of the cases, however, there was a birth injury. One was not unlike the case of the boy shown to-day.

Mr. DOYNE (in reply) said that he brought the case forward in order to obtain opinions as to its nature. The Wassermann was negative. The only point which occurred to him as an argument in favour of it being an excess of bone rather than a mere twisting of the skull, was that the right eye was hypermetropic to the extent of 2D. This might point to a shallower orbit, as the hypermetropic eye had a shorter long axis than the normal eye, and this might be produced if there was excessive bone formation, making the right orbit shallower than the left.

Epilöia.

By T. BRUSHFIELD, M.D.

C. W. B., MALE, aged 12 years. Admitted to Fountain Hospital, February 1, 1919.

History.—Father aged 29 years; mother aged 29 years; patient's grandfather died, aged 26 years, of epilepsy. Patient second of four children, rest of children normal. Labour normal; gestation worry throughout. Rash on face appeared at fourth year. Epileptic fits began at 18 months and continued till 4 years of age; then ceased. Patient had one fully developed fit in 1925.

Examination.—Fundi normal. Has grown a good deal lately. Wassermann reaction negative.

6 Brushfield: *Epilöia*

Cephalic index, 77; Porteous maze test, Binet scale, five years.

Reflexes.—Knee, right and left, +; ankle, right and left, −; plantar, right and left, flexor; abdominal, right and left, +; pupil, right and left, +.

Treatment.—By luminal.

At school: Drill and dancing class; meccano; plasticine, and simple hand tasks.

Result.—Progressing slowly.

This is one of sixteen cases at the Fountain Hospital, and it is the best-marked rash of any of them. They have been under me twelve years, and I have watched them and photographed them at different ages. The name "epilöia" was suggested by Dr. Sherlock. A search revealed that it has only been used since by Dr. Lind, of Australia, who had the benefit of seven post-mortem examinations; and his pamphlet on the subject contains full details of these. *Epilöia* is a syndrome comprising adenoma sebaceum, mental defect, epilepsy, sclerosis of the cerebral cortex, and internal tumours. Searching the records back as far as 1886, I find that one authority stated there were records of sixty cases of adenoma sebaceum up to that date. I have endeavoured to bring out two points. One is that the epilepsy begins in infancy, and it is usually *petit mal*, but I have had two cases with violent epileptic mania. The Jacksonian type of epilepsy has not been seen. The rash usually makes its appearance in the fourth year, synchronizing with the time that the sebaceous glands begin to secrete (Caylor). Therefore when our epileptics develop adenoma sebaceum, we begin to know what we have to deal with. The spots appear first in the naso-labial fold, and the condition is diagnosed by the presence of one or two pale pink spots in this fold, by the epilepsy, and by the mental defect. The chin and forehead remain fairly free from the rash. The child in whose case we carried out a post-mortem examination lived seven years, and we found the cerebral sclerosis to be enormous. In relation to the skin eruption, I will now show slides of these cases (slides shown).

Discussion.—Dr. J. D. ROLLESTON (President) said that he hoped that Dr. Sherlock would have been present, so that he might have been asked to justify his application of the term "epilöia" to the condition. He had looked up Dr. Sherlock's work [1] in order to see what he said, and found the remark that the term "has some of the features which, according to Pye-Smith, characterize a good name: it is short, unmeaning, distinctive, and capable of forming an adjective." The condition, apparently, was that known as tuberose sclerosis, as described some time ago by Bourneville. These cases were of considerable interest, especially to the dermatologist and the psychiatrist.

Dr. PARKES WEBER expressed his strong objection to the name "epilöia." Tuberose sclerosis of the brain had been most carefully studied in various countries and was known to be often associated with adenoma sebaceum of the face, also with fibromatous nævi in the skin, &c. For the brain condition the old term, tuberose or tuberous sclerosis, was sufficient. He had the further objection to the use of the name epilöia, that, if accepted, it must also be applied to persons who were mentally well-developed but happened to be suffering from adenoma sebaceum of the face. Dr. Brushfield's observations on the usual age for the first appearance of adenoma sebaceum were interesting.

[1] "The Feebled-Minded," 1911, p. 243.

Section of Comparative Medicine.

President—Sir D'Arcy Power, K.B.E., F.R.C.S.

Presidential Address.

By Sir D'Arcy Power, K.B.E., F.R.C.S.Eng.

I am told that it is the duty of the incoming President to open the proceedings of the session with a short address. Mindful of my own limitations and acting upon the sound advice laid down by Apelles, the Athenian painter, that a shoemaker ought not to criticize outside his trade, I cast about for a subject upon which to speak to you this afternoon. It occurred to me that if I told you something about those who might have been qualified for election as Honorary Members of this Section you would perhaps gain some information as to the manner in which comparative medicine came into being. We shall then see that, like a river, it had a common source in natural history, that it divided into the two streams of human and veterinary medicine—both empirical—and that these two streams have united to form comparative medicine, which it is the business of this Section to place and maintain upon a scientific basis.

There can be no doubt, I think, that Hippocrates would have been chosen as our first President unless, indeed, we had made him our Patron. His keen Greek intellect recognized that the diseases of men and of animals are closely allied, and either he or one of his pupils actually wrote on the diseases of animals. Aristotle would have joined our Section at once: "The Master of all that know," as he is described by Dante. A great investigator and a great thinker. He would have taught us much that was long forgotten and has now only been re-discovered.

But our first candidate for election as an Honorary Member would have been a man of colour, for he must certainly have been Mago, the Carthaginian, who was known as the "Father of Agriculture." He wrote a work in twenty-eight volumes comprising all branches of the subject. The work was so highly prized that after the destruction of Carthage, when the libraries which had fallen into the hands of the Romans were distributed amongst the princes of Africa, an exception was made in favour of Mago's work and the Senate ordered it to be translated into Latin. A Greek version appeared afterwards and an epitome in six books was made by Diophanes of Bithynia.

Xenophon, too, would certainly have been with us. We are accustomed from our schoolboy recollections of him to think only of his "Retreat of the Ten Thousand" and of his "Cyropædia," but he had a very real interest also in horses and seems to have had some practical experience in their management.

Sir Frederick Smith has epitomized Xenophon's rules for "The Choice, Management and Training of Horses," and says that he tells horse-owners that nothing but

close supervision will prevent their horses being robbed of their food, and that standing in dirty stables ruins their feet. The horses, of course, were not shod, and he recommends that the stable flooring should be of stones, each the width of a horse's foot. By increasing the slope of the stable floor—which he specially directs—and placing the horse on cobble-stones, he secures the feet being kept dry and the sole exposed to air-currents. Xenophon sums up his principles of management in the words, "keep the hoofs hard and the mouth tender." He deals also with the ordinary stable operations of grooming, removal of litter and the bridling of horses at a time when there was no saddle. He gives detailed instructions for grooming and condemns the habit of washing the legs, which, he says, should be hand-rubbed in order to remove the dirt. He impresses upon his readers what he calls his first and best precept, which is, never to be angry with a horse.

Vegetius was well qualified to hold office amongst us, for he says, in his "Ars Veterinaria," that to assist him in the compilation of veterinary matters he had called to his aid existing veterinarians and physicians, though he forgets to add that he owes a great deal to the works of Mago, the Carthaginian, of whom I have already spoken. Vegetius was far in advance of his time, for he ridicules the idea of disease being evidence of Divine wrath and recommends that dead animals should be buried deeply.

Pliny would undoubtedly have been invited to become an Honorary Member of the Section. Like the Master of Balliol he took all knowledge for his province, and his "Natural History" is still one of the most readable and entertaining books in existence. I would strongly advise all of you to dip into it from time to time. If you can get Philemon Holland's translation you will even go to the expense of buying an armchair with a reading desk to support its great weight, and the long winter evenings will pass all too quickly whilst you read how

> "Horses', of all other creatures, teeth wax whiter by age, for in the rest they turn to be brown and reddish. The age of Horses, Asses and Mules is known by a mark in the teeth; a horse hath in all forty. At the end of thirty months he loseth his fore teeth of either jaw as well above as beneath: the year following as many, even those that be next, namely at what time as they put out those which be called the cheek-teeth. At the beginning of the fifth year he loseth other two, but there come up new in the place in the sixth year. By the seventh year he hath all, as well as those that should come in others place as those which are firm and never change. A gelding never casts his teeth, no not his sucking teeth, in case he were gelded before; Asses in like manner begin to shed their teeth at the thirtieth month of their age, and so forward from six months to six months; and if they foal not before they have shed their last teeth, they are for certain to be held barren. Kine and Oxen when they be two years old do change their teeth. Hogs or swine never have any teeth to fall. Now whenas these marks are gone out which show the age of horses, asses and such like, ye must (to know their age) go by the overgrowth and standing out of the teeth, the greyness of the hair over their brows and the hollow pits thereabout, for then are they supposed to be sixteen years of age."

And so Pliny goes babbling on, sometimes of the breed of mice and rats, sometimes of the pestilence which, beginning in the south, goeth to the west and continueth but three months. Everything he writes of is interesting—the old mingled with the new and the book containing half the folk beliefs of the world.

Next to Pliny we must have elected Cornelius Celsus, a writer of whom it is still in dispute whether he was a practising doctor, a veterinary surgeon or merely a literary Roman gentleman with scientific aspirations. I place him after Pliny because his scope is more limited and his style is less interesting. I am to some degree biased against him, perhaps because I was obliged to read him for examination

purposes when I took my M.B. degree at the University of Oxford. He would undoubtedly have been welcomed here because he said that:—

"No one thing is a sole cause, but that is taken for the cause which seems mainly to have contributed to an effect. That which singly has not the power of exciting disturbance may do so in the highest degree when it acts conjointly with other causes."

He says, too, that:—

"The art of medicine hardly admits any precepts of general application, and even cattle doctors since they cannot learn the idiosyncracies of dumb animals insist on observation rather on theories in cases of disease."

Leaving the ancients we should have admitted Conrad Gesner to our ranks with the utmost joy. He was named the German Pliny, but he did more than Pliny, for he awakened natural science from its long mediæval sleep, and his "Historia Animalium libri II" deals at large with the habits and diseases of animals. He was certainly one of the best beloved men of his time and he was the most learned. He practised for many years at Zürich, and when he died at the age of 49 from the plague Beza wrote of him:—

Natura te omnis denique suorum
Fidum antistitem plorat sacrorum; muta
Futura deinceps, ni loqueris mortuus.

I sometimes think that our first President, Sir Clifford Allbutt, was Conrad Gesner re-incarnated; both at any rate had the same type of encyclopædic mind.

Gervase Markham is next on the list of candidates for the Honorary Membership. He might have been elected, but it is very likely that he would have been badly blackballed. He wrote his Masterpiece in 1644 saying that it contained "all knowledge belonging to the smith, farrier or horse-leech touching the cure of all diseases in horses drawn with great pain from the public practice of all the foreign horse markets in Christendom and from the private practice of all the best farriers of this kingdom." The promise seems fair at the outset, but hear what is said of him by Major-General Sir Frederick Smith:—

"He was a soldier, a scholar, a gentleman of fortune, a minor poet, a literary hack and a social parasite. He was a most versatile person and wrote with facility and assurance on any subject. For reasons of pelf he chose during long periods of his life to write on veterinary matters and to pose as a practitioner. He knew nothing of his subject and was not only a mean plagiarist but a violently untruthful person."

On the other hand he was observant and had a trained mind, so that perhaps if he had been elected a Member of the Section we might have made him a real authority in comparative medicine.

Robert Lovell we should have admitted because of his "Compleat History of Animals and Minerals with their Place, Natures, Causes, Properties and Uses." He was a student of Christ Church, Oxford, and was the exact antithesis of Conrad Gesner, for he stood on the old road and his book is a mere re-statement of what was well known to the naturalists of classical times. It reads as if he had compiled it from the Bodleian and Christ Church Libraries. Still he was a gentleman, and had an interest in men and animals, so that we should have been glad to see him amongst us.

Thus far the tradition of Comparative Medicine had been kept alive by physicians who had interested themselves in natural history. It now passed to the surgeons and to a few veterinarians, like Sainbel, who introduced some knowledge of their art from France, where it had long occupied a higher position than it had done in England.

John Hunter would assuredly have been elected our first President had the times been ripe for inaugurating a Society of Comparative Medicine during his lifetime. He loved to found small and friendly societies—such as ours—where men could meet informally and discuss the problems in which they were mutually interested. Some of these little coteries even met at his own house, for he was an admirable host. If such a Society had been formed he would certainly have enlisted the youth and energy of Astley Cooper to act as Secretary, whilst the elder Cline and William Foart Simmons would as certainly have been put upon the council. Edward Jenner would have been seduced into reading a paper, and perhaps Monro secundus, of Edinburgh, might have demonstrated before us the stomach pump which he had invented for the relief of acute tympanites in cattle.

Charles Vial de Sainbel would have come to the meetings to show his appreciation of John Hunter's help when he founded the Veterinary College in Camden Town. His contributions would have been of great value, for he was the first to introduce into England the science of veterinary practice as it was understood in France as a result of the teaching of Claude Bourgelat.

Coming to our own time we should have elected William Kitchen Parker and his great expositor, Thomas Huxley, Honorary Members of the Section, less for their knowledge of disease than for their great scientific attainments in comparative anatomy, and they would have helped us in many points of anatomical detail.

Parker I knew well, as he was a personal friend of my father, and when I was a boy we often went in to watch him at work on a summer evening. He lived at 18, Bessborough Street, Pimlico, and used to preach on Sundays in the Wesleyan Chapel in Claverton Street. He was the son of a small Lincolnshire farmer and he told us that one day after a morning's ploughing he came home and said: "Father, I am fit for something better than this. I'll go to school and plough no more." He obtained the L.S.A., married, had a large family and made a scanty livelihood by the practice of his profession. His interests lay wholly in science, and, when we knew him, he was working at the homology of the shoulder girdle and the structure of the vertebrate skull—work which secured his election as a Fellow of the Royal Society and afterwards the award to him of the Gold Medal of the Society. Dining there once in the middle of the day we had a cod's head and shoulders and we were warned to be very careful not to injure the bones "because father was going to make a skeleton of them afterwards." Parker was a morphologist pure and simple. It was a delight to see him working at a frog's skull, his only instruments being a pair of dissecting forceps, a pair of scissors and two darning needles fixed in small splinters of wood for handles. His demonstrations were easy to follow, for he showed every point as he spoke, but with the enthusiasm of genius he soon wandered off and, speaking in the language of the Bible, Shakespeare and Milton,—works he knew

Section of Comparative Medicine 5

literally by heart—he soon lost us in realms of thought which even Huxley was not always able to make clear to our lower intellects. To us in this Section he would have been of the greatest value, for his knowledge of developmental processes in the vertebrate skeleton would have explained many of the structural variations occurring in men and in animals.

It thus comes to pass that by a gradual process of development and the spread of knowledge, a Society for the study of Comparative Medicine has become possible. We owe much to Sir Clifford Allbutt and also to Sir German Sims Woodhead, who wished to establish a Society of Comparative Pathology at Cambridge many years ago. The advantages of such a Society had been shown us at the Pathological Society, for the medical members learnt much and had their ideas greatly widened whenever we had the good fortune to get a member of the veterinary profession to take part in any discussion that was going forward. The veterinary surgeon we found viewed things from an entirely different angle and was often able to add pertinent facts of which most of us were wholly ignorant. The project of forming a Society of Comparative Pathology was talked about, the usual objections to its existence were raised, but on the whole it was agreed very generally that such a society would be of great value. No one, however, came forward as an active spirit to call it into existence and it was not until the veterinary side of the profession took up the matter that the long-wished-for scheme became an accomplished fact. The original proposal to have a purely scientific society dealing only with comparative pathology was widened, and I think wisely, into one dealing with comparative medicine, and it was decided to make it a Section of the Royal Society of Medicine. The influence of your first President, Sir Clifford Allbutt, and the energy of your second President, Major Hobday, together with the zeal of your secretaries has already made the Section a conspicuous success, and it remains for all of us to maintain and even to enhance its present position by contributing of our knowledge and taking part in the discussions. The work of the Section embraces a vast field extending on the one side to the most difficult problems of human medicine and on the other to the inter-relation of human and veterinary science, showing thereby that the processes of disease are identical whether they occur in men or in animals. It touches, too, the confines of tropical medicine, the most virile, the most progressive and to us—as Englishmen—the most valuable of all branches of medicine, for we are a great colonizing race, whose interest it is to make the tropics healthy for our countrymen. For this reason our honorary secretaries have arranged this session for a discussion jointly with the Section of Tropical Diseases. The subject chosen is "Trypanosomiasis," a subject which Sir William Leishman had made his own and we had hoped to learn much from him. We propose, also, to discuss tuberculosis in men and animals, as well as rheumatism and rheumatoid changes in their protean aspects, whilst, owing to the good offices of your late President, Major Hobday, we have secured the promise of a paper from Professor Möllgaard of Copenhagen.

There is one final remark I should like to make. As a writer of many papers may I say, without giving offence, that when you have promised a communication and have yielded to the seductive voice of the Secretary "just to put together your

experience in a little paper," to write it at once. Pressure of work is no excuse for putting off the evil day, for then the matter as well as the style suffers. I know there is high authority for postponement, for Sir Rickman Godlee tells us that Lord Lister usually wrote his addresses at the last minute and sometimes left them so late that they were never finished, and that he had to trust to his memory for the concluding sentences. I have the highest admiration for that great surgeon but in this I think he erred.

The Presidential address is ended and I have only to wish the Section God-speed.

[*Postscript.*—The works of most of the writers mentioned are contained in the Library of the Society.]

Section of Dermatology.

President—Dr. J. H. SEQUEIRA.

Two Cases: (1) Macular Atrophy of Syphilitic Origin. (2) Lichen Nitidus: Confluent Type.

By G. B. DOWLING, M.D.

Case I.—PATIENT, male, aged 44. Suffering from two eruptions, one a tertiary syphilide near the left elbow, the other disseminated over the back, chest and shoulder.

History.—Primary syphilis with phagedæna, twenty-four years ago, followed within three months by a generalized eruption of raised pink spots "like blisters," which within another few months subsided and assumed their present aspect. They have undergone no further alteration. The epidermis over these lesions remained unbroken throughout. Though patient's description is somewhat vague, it appears that his early eruption was some kind of secondary syphilide.

On Examination.—There are a large number of round or oval lenticular elevated spots, symmetrically disposed and distributed mainly along the lines of cleavage, over the back, chest and abdomen, and on the shoulders. Some are rather firm, others soft and compressible, exhibiting "cigarette-paper" wrinkling.

A point of interest is the close resemblance to some of the reported cases of multiple benign tumour-like new growths of Schweninger and Buzzi, particularly a case reported by Pusey, which appears to have been practically identical, and one by Crocker, apparently due to syphilis. The difference is evidently a question of the degree of bulging, and Buzzi's disease is no more than a macular atrophy, though not necessarily due to syphilis.

Case II.—Patient, female aged 28.

History.—Has suffered for about a year from an eruption associated with slight irritation, distributed over various parts of the body, including the extensor aspects of the elbows and knees and the front of the wrists. The elementary lesions are the characteristic flat papules of lichen nitidus. Over the knees and elbows and on the front of the wrists these have become confluent, and form a red patch with a brownish tinge resembling lichenification at first sight. At the margins of the confluent portion, however, can be seen the characteristic discrete papules. The patches over the knees and elbows are roughly triangular, with the apex pointing downwards, a point to which my attention was drawn by Dr. Barber. Evidently friction plays a part in the production of these confluent patches.

Histologically, the sections show the characteristic subepidermal infiltration consisting of a mixture of small round cells and epithelioid cells: in the portions where the eruption is discrete arranged in circumscribed dense groups; in the confluent part almost as a sheet. The epidermis shows the characteristic erosion from beneath, amounting to an almost total disappearance in the confluent parts in some places, except for some parakeratotic cells and a rather thickened horny layer.

The case is a good example of the type recently described by Dr. Barber.[1]

[1] *Brit. Journ. Derm.*, April, 1926, pp. 143-156.

Two Cases of Pigmentation: (1) Argyria; (2) Pigmentation of Unknown Origin.

By HALDIN DAVIS, F.R.C.S.

THESE cases both exhibit anomalies of pigmentation. The first is a case of argyria due to the ingestion of silver nitrate pills, at one time a fashionable remedy for indigestion. The patient, some twenty years ago, took these pills three times a day for a period of about twelve months. The alteration in colour came on *after* she had ceased taking them and has persisted almost unchanged ever since, although she thinks that the tint is not so dark now as it used to be. Argyria is a very capricious condition. I have had a case under my care in which the only source of silver was protargol in a six weeks' course of swabbing the vagina daily; nevertheless, the patient developed the characteristic pigmentation, which however disappeared after three years. It must be very exceptional for argyria to develop from the use of protargol, otherwise we should see more of it, as protargol is widely used for certain conditions and I have never heard of any other case ascribed to it.

In the second case the origin of the pigmentation is still unknown, but I am assured by Dr. Barber that it falls into the category of a case described by Civatte as "reticulated pigmentary poikilodermia." Members will recall Dr. Barber's similar case recently shown.[1] In that case there was atrophy of the skin; in this patient there is no atrophy although the condition has now been increasing over three years. The patient has had menstrual troubles for about six years and I am inclined to think that perhaps in some obscure way they have been instrumental in causing the pathological changes in the skin.

A Case of Recklinghausen's Disease, shown in 1905, as an Early Pigmentary "Forme Fruste."

By F. PARKES WEBER, M.D.

THE patient, a married woman, aged 36, now presents the characteristic features of Recklinghausen's multiple neuro-fibromatosis, with much cutaneous pigmentation in spots and patches of various sizes and shades; there is diffuse brown pigmentation over the back of the thorax and neck. The "molluscous" fibromatous tumours are of various sizes and mostly sessile, and they are scattered over her whole trunk and limbs. Some of the tumours are much softer than others. There is a peculiar diffuse, soft one which forms a cushion in the subcutaneous tissue over the dorsum of the middle segment of the left index finger, and a much larger one forms a diffuse swelling in the subcutaneous tissue of the lower outer part of the right thigh, just above the knee-joint. During the last two or three months the patient has noticed a slightly tender swelling on the right side of the lower part of her neck, which may be connected with a nerve-trunk (a plexiform neuroma). The nipple-region of both breasts is involved by molluscous growths. She has had four children, of whom only the fourth is living, aged seven months. Wassermann reaction negative. Brachial blood-pressure (systolic), 120 mm. Hg; (diastolic), 80 mm. Hg. By ordinary examination I find nothing abnormal in the thoracic and abdominal viscera.

[1] *Proceedings*, 1926, xix, p. 60.

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The illustration (from a photograph taken in September, 1926) should be compared with the patient's appearance as illustrated in the previous account of the case. The diffuse pigmentation of the upper part of the back and neck was then a striking feature. I first showed the case in May, 1905, at the (old) Dermatological Society of London, and in the published account (*Brit. Journ. Dermat.*, London, 1905, xvii, p. 226) it is described as "A Case of Unusual Cutaneous Pigmentation, in a Girl, aged 14, possibly allied to Recklinghausen's Disease"; the case was published in fuller detail in 1909, under the heading, "Cutaneous Pigmentation as an Incomplete Form of Recklinghausen's Disease" (*Brit. Journ. Dermat.*, 1909, xxi, pp. 49-53, with illustration). I gather that Siemens (*Derm. Zeitschr.*, Berlin, 1926, xlvi, p. 168)

Case of Recklinghausen's disease.

has concluded that so-called "incomplete forms" of Recklinghausen's disease are mostly *typical early cases*, which, later in life, develop the complete picture.

A minor feature of the case is that the patient developed typical xanthelasma palpebrarum when she was 18 years old; she has now symmetrical crescentic bands of xanthelasma involving the internal portions of both upper and lower eyelids. The xanthelasma palpebrarum is familial, for the patient's mother has it likewise; and this is specially interesting, as both the patient and her mother used to suffer from recurrent "bilious attacks" in youth. The blood has unfortunately not been examined for hypercholesterinæmia in either of them.

21 Parkes Weber: *Pigmentation of the Thigh, with Varicose Veins*

Pigmentation of the Thigh, with Varicose Veins and a Condition somewhat resembling so-called "Multiple Idiopathic Hæmorrhagic (Pigment) Sarcoma" (Kaposi).

By F. Parkes Weber, M.D.

The patient, Mrs. M. R., aged 47, is a rather fat and "plethoric" Hebrew woman from Galicia, who has varicose veins of both lower extremities, worse on the inner aspect of the right thigh. During the winter of 1925-1926, over the inner aspect of the right thigh just above the knee-joint, she developed some irregularly-shaped raised, flat, rough, dark-purplish lesions in the skin, which were associated with much local pruritus. I saw her in May, 1926, and since then under local external treatment by chrysarobin, &c., and the internal use at first of small doses of sodium salicylate and sodium bicarbonate and then of an arsenic preparation (subcutaneously), the itching practically left her, but the lesions, though perhaps diminished, did not disappear. Adjoining these lesions above is an irregular circumscribed area of brown cutaneous pigmentation (see illustration from a photograph taken by Mr. A. Höppner

Pigmentation of the thigh.

in September, 1926), which never itched and is said to have appeared about a month before the cutaneous nodules were first noticed.

The pigmentation and the cutaneous nodules macroscopically somewhat resemble the lesions of so-called "multiple idiopathic hæmorrhagic (pigment) sarcoma" (Kaposi), but the question arises whether the pigmentation may not be merely a pigmentary disturbance connected with varicose veins and whether the cutaneous nodules may not be a modified chronic form of lichen planus or so-called "lichen obtusus corneus." I am indebted to my surgical colleague, Mr. A. Compton, for having excised one of the nodules and for having given me stained microscopical sections of it. On these biopsy-specimens I asked Dr. A. M. H. Gray's opinion and he kindly sent me the following report:—

"I think the lesion is strongly suggestive of lichen planus. There is a circumscribed infiltration, mainly of round cells, in the papillary and sub-papillary layers associated with an

irregular overgrowth of all the epithelial layers overlying it. There is a marked keratosis of the follicular openings, both of the hairs and sweat ducts, I think. I note also marked dilatation of the vessels in and around the lesion and some dilatation of the sweat-coils. There is an increase in the pigment, chiefly in chromatophores in the superficial dermic layers. These are a few points which to me are very suggestive of lichen planus."

It is well known that Sir Jonathan Hutchinson described lesions resembling so-called "multiple idiopathic hæmorrhagic sarcoma" as occurring in plethoric and gouty individuals. I would ask the opinion of those present as to the nature of the condition and as to the advisability of locally trying X-rays. I might add that the Wassermann reaction is completely negative.

Hypoplasia (Aplasia) Pilorum Moniliformis.

By F. PARKES WEBER, M.D., and J. AXHAUSEN, M.D.

THE patient is a boy, aged 3 years (in September, 1926), with hypoplasia pilorum moniliformis and follicular keratosis of the hairy scalp. The scalp is rough from the keratosis and slightly scaly at parts and sometimes reddened; the hairs are all extremely short, mostly only a few millimetres in length (fig. 1). The stumpy hairs

FIG. 1.—Hypoplasia pilorum moniliformis. To show the appearance of the scalp and the pigment-nævus of the forehead.

and rough skin of the scalp give a characteristic sensation when felt with the palm of the hand. The short hairs can easily be pulled out and many of them present a beaded (moniliform) appearance even to naked-eye examination. Under the microscope this beaded appearance is seen to be due to alternate constrictions and spindle-like (fusiform or moniliform) enlargements of the hairs—whence is derived the name *hypoplasia* (or *aplasia*) *pilorum moniliformis* or *intermittens*. The unstained affected hairs, when examined by transmitted light, mostly show a fusiform, very dark (apparently deeply pigmented) enlargement of the medullary substance in the nodes, whereas the internodes are mostly paler. The appearance is, however, quite different from that of "ringed hairs" ("Ringelhaare"), in which there are no true constrictions, the rings being due, it is said, to the presence of air in alternate segments of the affected hairs.

26 Parkes Weber and Axhausen: *Hypoplasia Pilorum Moniliformis*

The shortness of the moniliform hairs is due to their general hypotrophic condition and especially to their tendency to break off as soon as they project a few millimetres from the skin; in the present case the fracture invariably occurs at one of the thin segments (internodes), between the fusiform enlargements; the fracture never leaves a definite brush-like extremity (thysanotrichia, "Pinselhaar"), such as it does in "trichorrhexis nodosa." There is variability in the degree and frequency of the fusiform enlargements (nodes) and in the length of the thin (internodal) segments; the

FIG. 2.—This illustration shows three unstained monilithrix hairs under low magnification (× 45) by transmitted light. The first is from the boy's scalp, and the middle portion of the hair has been omitted. The intervals between the nodal enlargements are unequal in length, and the proximal three nodal enlargements are free from the dark medullary content, which is well marked in the more distal enlargements. The second is an upper eyelash hair which is only slightly moniliform, and the dark "medulla" is continuous through the constricted segments; the distal portion of the hair (not included in the figure) was not moniliform. The third is a typical moniliform hair from one of the eyebrows in which the dark medullary content is almost limited to the nodal enlargements.

hairs are not equally affected; some are not, or only very slightly moniliform, and parts of single hairs are more affected than other parts. The hairs are often otherwise badly formed or hypotrophic.

The eyebrow-hairs are very fine and scanty, and some of them are definitely moniliform; there is no obvious follicular keratosis of the eyebrows. The eyelashes, when examined with an ordinary lens, look curiously broken and irregular in length, and some of the eyelash-hairs are definitely moniliform. The fine lanugo hairs from the "smooth" forehead-skin are apparently not moniliform. The illustration (fig. 2) shows (× 45) three monilithrix hairs, respectively, from the boy's scalp, from his upper eyelash, and from his eyebrow. Of the scalp hair only the two ends are figured. It should be noted that the eyelash hair is relatively slightly affected; the distal portion (not included in the figure) was not moniliform; and the dark "medulla" is continuous through the constricted segments.

About the middle of the front of the forehead there is an ordinary simple pigmentary nævus. Over the external posterior surfaces of both legs is some slight lichen pilaris (spinulosus), and the boy also suffers from ordinary urticaria papulosa of children ("strophulus" of continental writers, "lichen urticatus" of Bateman). Otherwise there is nothing special to be observed in regard to the skin and the skin-appendages in the present case—no ichthyosis, no abnormality (hypoplasia or aplasia) in nails or teeth, such as has been recorded in some cases of congenital hypoplasia pilorum moniliformis and "congenital alopecia." Ophthalmoscopic examination shows nothing abnormal. The boy is well grown and free from any visceral defect.

He is an only child, of English Hebrew parentage. The father and mother appear healthy (the mother has never been pregnant excepting with the patient) and there is no family history of any abnormality of the hair or skin. According to the parents the boy was born at full term with a little hair on his head which soon came away. Then he remained bald, excepting for a little short hair on the front part of the top of the head, till about two years of age (about a year ago); since then there has been a growth of stumpy hair all over the "hairy scalp," as there is at present. According to the parents, the skin of the hairy scalp has always been somewhat rough and "pimply" (follicular hyperkeratosis). The eyebrows were smooth and bald until about five months ago, when a scanty growth of eyebrow-hair occurred without any obvious follicular hyperkeratosis.

REMARKS.

The present case seems to be a fairly characteristic one of congenital hypoplasia pilorum moniliformis or intermittens (monilithrix, monilitrichia, "Spindelhaare," "beaded hair"), with moderate follicular keratosis of the scalp, in an otherwise normally developed boy, but there is no family history of a similar condition. It should be noted that the defective condition of the eyelash and eyebrow hairs has not been associated with any obvious follicular keratosis (to the naked eye), and in this disease, the moniliform and defective condition of the scalp hairs, though usually associated with more or less follicular keratosis, seems not to be entirely due to the keratosis. The disease is probably allied to MacLeod's "ichthyosis follicularis,"[1] though MacLeod did not actually find moniliform hairs in his cases. Nor was the occurrence of moniliform hairs noted in Taenzer's cases of "Ulerythema ophryogenes,"[2] which MacLeod regards as possibly a severer form of his "ichthyosis follicularis," with progressive cicatricial changes.

We suggest that there may be a series of allied conditions differing in severity and in the relative amount of follicular hyperkeratosis: at one end of the series may

[1] J. M. H. MacLeod, "Three Cases of Ichthyosis Follicularis associated with Baldness," *Brit. Journ. Dermat.*, London, 1909, xxi, pp. 165-189.

[2] Paul Taenzer, "Ueber das Ulerythema ophryogenes," *Monats. f. prakt. Dermat.*, Hamburg, 1889, viii, pp. 197-208.

be cases of congenital alopecia and at the other end may be MacLeod's cases of "ichthyosis follicularis," whereas in the middle may be the cases of typical congenital hypoplasia pilorum moniliformis associated with more or less follicular keratosis.

It is obvious that monilithrix must be regarded as an inborn abnormality of development and therefore as belonging to or allied to the large class of nævi. Whether it belongs to, or is only allied to, the nævus class, depends on the definition of the term "nævus." We would say that a nævus, of whatever distribution, may be: *hyperplastic* (as, for instance, ichthyosis hystrix and congenital patches of sclerodermia-like thickening of the cutis and subcutaneous tissue), *hypoplastic* or *aplastic* (as in cases of congenital local absence of cutaneous blood-vessels or cutaneous pigment, i.e., nævus anæmicus and nævus leucodermicus or congenital piebaldism—and in congenital local hypoplastic defects in the skin and subcutaneous tissue), *dysplastic*, or *heteroplastic*. Obviously also there may be various combinations of these qualities in nævus-formation.

The association of congenital hypoplasia pilorum moniliformis with lichen spinulosus may be compared to the occasional association of folliculitis decalvans in adults with lichen spinulosus, as noted by Graham Little and others.

Case of Lichen Spinulosus.

By H. W. Barber, M.B.

J. C., MALE, aged 12. *History.*—The eruption was first noticed ten weeks ago on the legs: it appeared later on the arms and then on the neck, face, and trunk. It was unaccompanied by any constitutional disturbance. More recently an eruption (? perlèche) developed at the corners of the mouth, but this had practically disappeared when the boy first attended hospital.

The eruption is widespread, involving principally the limbs, and, to a less extent, the trunk, neck, and face. It corresponds to that described by English authors as lichen spinulosus, that is to say it consists of follicular papules with projecting horny spines. The majority of the horny papules are of the colour of normal skin, but some are slightly reddened at the base, indicating a mild inflammatory reaction. On the thighs, the primary lesions are arranged in more or less circular groups, such as are seen in lichen scrofulosorum. The elbows and knees are practically unaffected. On the neck the papules are very closely set, and project much less above the surface of the skin than on the limbs and trunk. The face, at the boy's first visit to hospital, was covered by a fine furfuraceous scaliness, and at the angles of the mouth there were traces of an eruption resembling "perlèche." On the mucous membrane of the left cheek were a few red spots, but nothing resembling the lesions of lichen planus.

Dr. Dowling has pointed out to me that this case corresponded to those described by Peyri Rocamora [1], of Barcelona, in the *Annales de Dermatologie et de Syphiligraphie*, of 1922, under the title of an "Epidemic of Keratosis Follicularis." Rocamora encountered fourteen cases in a children's home. The photographs and description of his cases correspond exactly with the appearances seen in my patient, and he describes the same furfuraceous scaling of the cheeks; but in all his patients there was a stomatitis, which was resistant to treatment, and on the tongue were patches not unlike syphilitic lesions. The author gives an account of the histology, which confirms the findings of Dr. Adamson [2] in his admirable review published in 1905. Rocamora also carried out a bacteriological investigation of the follicular horny cones and of the patches around the mouth, but he succeeded in growing only

a *Staphylococcus albus*, which, nevertheless, he suggests may be the causal infective organism, a view that can hardly be regarded seriously. Finally, he discusses the relationship of his cases to similar follicular eruptions described under various titles by other observers, including the lichenoid trichophytide of Rasch and others. There was no trichophytosis in his cases.

It is possible that these cases are the same as those labelled by Brooke [3]

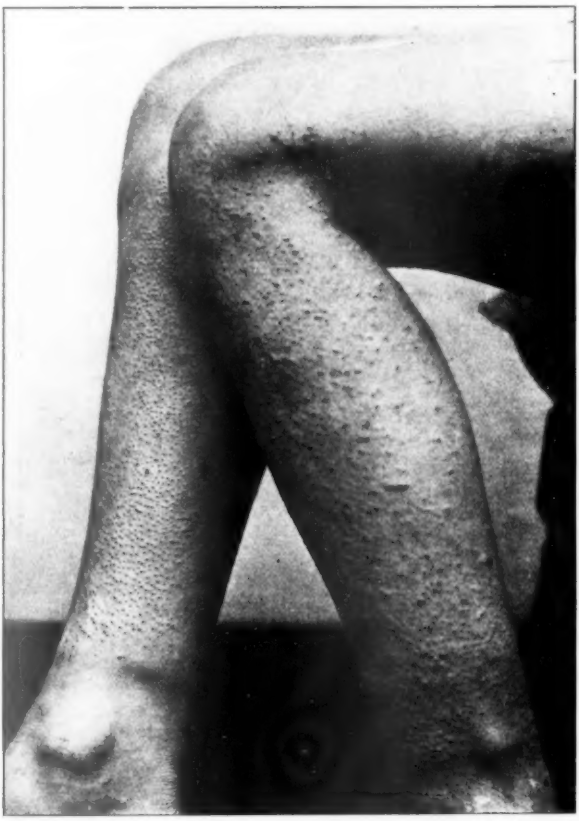

FIG. 1.

"Keratosis follicularis contagiosa," but, as Dr. Adamson remarks, the plate published by Brooke does not suggest the appearances of lichen spinulosus.

Dr. Graham Little has also published cases, three of which occurred in the same family, the familial incidence thus being common to his patients and to those of Brooke.

Lastly, the relationship of lichen spinulosus to folliculitis decalvans and of both to lichen plano-pilaris has to be considered. In this connexion it is of interest to note that Peyri Rocamora observed in some of his cases isolated horny perifollicular

30] Barber: *Lichen Spinulosus;* Little: *Nodular Leprosy*

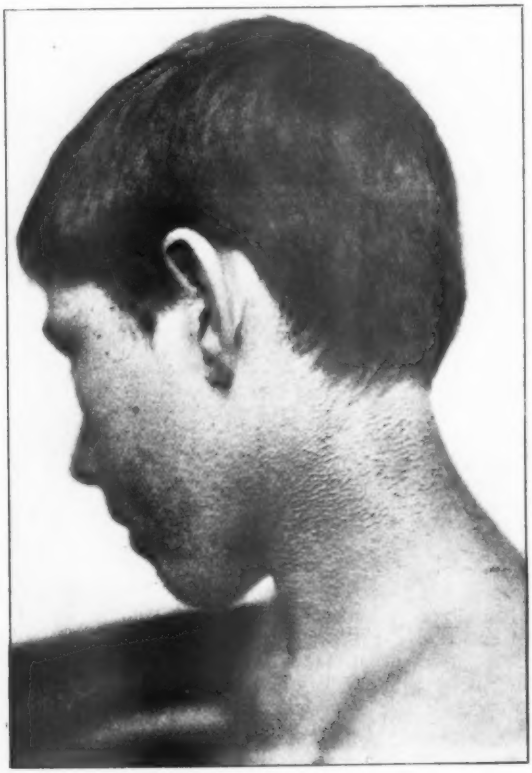

FIG. 2.

papules on the scalp, but without alopecia or atrophy of the hair-follicle; and in one case a small patch of alopecia in the occipital region, which, however, the author did not associate with the lichen spinulosus.

REFERENCES.

[1] ROCAMORA, *Annales de Dermat. et de Syph.*, 1922, 5e série, tome iii, p. 209. [2] ADAMSON, H. G., *Brit. Journ. Dermat.*, Feb. and March, 1905. [3] BROOKE, H. G., "International Atlas of Rare Skin Diseases," 1892.

Case of Nodular Leprosy, previously shown; improved under Treatment.

By E. G. GRAHAM LITTLE, M.D.

THIS case is one of nodular leprosy, of acute onset. I showed it at the meeting held in May, 1926.[1] It is one of the most acute cases of nodular leprosy that have been seen in this country. The patient is a native of the East, who, when first seen, had been living in England for seven or eight months. The eruption was so acute that his family doctor regarded it as acute urticaria. When I showed the case in May, the condition was considered so serious that I was urged

[1] *Proceedings*, 1926, xix (Sect. Derm.), p. 65.

to advise the patient to return to the East as quickly as possible. He did not return home, but went under treatment by Dr. Hasson, to whom the amazing improvement in his condition is entirely due. Dr. Hasson will describe his method and give the evidences of one of the most remarkable cases of complete involution of the disease that has probably ever been recorded. No lepra bacilli can be detected in the mucosa of the nose, or in the blisters artificially produced by freezing the leprous tissue, when the leprous sites are frozen for a minute, and a blister results; usually the blister is full of lepra bacilli. In this case the tissue has been frozen experimentally for the purpose of looking for the bacilli, and the search has consistently failed since the immense clinical improvement took place in his condition. We are all familiar with cases of leprosy which have been treated with emulsions of leprous tissue. I am sorry Dr. Winkelried Williams is not here, because he was one of the first to carry out those experiments with leprous tissue. This present process is entirely different and more effective. I have watched cases in which leprous lesions have been treated by the emulsion method, but without much success.

Discussion.—Dr. HASSON said he had seen many cases of leprosy treated with chaulmoogra oil. 400 patients had been injected with it, all having the same treatment, but there was no improvement. He had seven of these cases, and they became so much worse that the treatment was stopped. In 1923 he began to treat his leprosy patients with a special vaccine; not an autogenous, but a stock vaccine. In order to make the preparation, a special technique was needed. The patient was blistered with CO_2 snow. The pencil of snow was placed on the anæsthetic patch, where a blister then formed. He collected the contents of that blister, and after centrifuging for twenty minutes he washed the bacilli with petrol-ether and put five milliards of bacilli into 2 c.c. of normal saline, and then added fifteen milliards of *Bacillus pyocyaneus* to intensify its effect. This patient, when he came, was in a very serious condition; it was a very acute case of nodular leprosy, one of the worst he had ever seen, as there were anæsthetic patches all over the body. All sensation had gone from the ulnar nerve, from its tip almost to the elbow; and the skin of the wrist was so infiltrated that it was ¼ in. thick. There were lesions all over the face, and the patient's general condition was bad. He found slight atrophy of the thenar and hypothenar muscles of the left hand. The patient had been sent to him (the speaker) by Dr. Manson-Bahr, and in a fortnight a wonderful improvement had occurred. The man received, in all, fifty-three injections of the vaccine, most of them into veins—a very important point—and some of them under the skin. After six weeks the patient was, as one might say, cured, and yet he should not say that, because we did not know whether there might not be a recurrence up to five years. But all the signs of leprosy had disappeared, and one could not say now, from looking at him, that this man had suffered from Hansen's disease. The injections were made once or twice a week, twice in the veins to once in the skin. A shock reaction followed the injection, with shivering, a rise of temperature, and profuse perspiration, but it was not of serious import, as on the next day the patient had recovered from it. He had now forty-five cases which had been completely cured. One of them had been sent to him (Dr. Hasson) by Dr. Manson-Bahr, from the Hospital for Tropical Diseases; this patient had had only six injections, and he was cured. Another case was that of a man from South America, who had had nodular papular leprosy, the mixed form of nodular and papular. He had been sent to him (Dr. Hasson) from Buenos Aires, and in six weeks he was cured.

Dr. J. H. SEQUEIRA (President) said that the Members of the Section were very grateful to Dr. Hasson, and congratulated him on his results.

Glossitis Migrans; a large unknown Coccus present.

By E. G. GRAHAM LITTLE, M.D.

I HAVE had a series of three cases of a condition of the mouth and tongue which, clinically, would be described as glossitis migrans in one case, and in the other two possibly as leucoplakia of the lichen planus type. There is no lichen planus in the

two cases mentioned. A very large coccus, unfamiliar to the Bacteriological Department at St. Mary's Hospital, has been isolated from all three cases. The coccus has been grown by Dr. Dyson anaerobically, though with very great difficulty. I shall ask him to send a communication about it later.

Infection (? Tuberculous) of the Skin following Electrolysis for Removal of Hair.

By E. G. Graham Little, M.D.

The patient, a female, has a lupoid infection of the skin, which came on after electrolysis for removal of superfluous hair by a lay operator in the Midlands. The first effect was very good. Dr. Dorothy Summers, of Leeds, wrote to me about it, and she says no scarring followed the treatment. Two years later, the patient began to show these red areas, and she has been treated by local doctors for rosacea for some months. I saw her a few weeks later, and I think there is now no doubt that the condition is tuberculous. How far the electrolysis is responsible for it I do not know; I have never met with a case in which electrolysis has been responsible for a tuberculous infection.

Case of Traumatic Alopecia.

By H. MacCormac, C.B.E., M.D.

The patient, a man, aged 25, came under observation with an ordinary form of impetigo: the condition of the scalp for which he is now shown was then noticed. It first appeared nine or ten years ago, and is due to his occupation as a Covent Garden porter. The lesion consists of a sharply demarcated area of baldness over the vertex, not unlike a monk's tonsure, from which the hair has been almost completely rubbed off, and in which the skin has become slightly lichenized, as a consequence of carrying weights on the head. As the condition bore a superficial resemblance to ringworm of the adult scalp this was excluded by microscopic examination of the hairs.

[The patient tells me that this form of traumatic alopecia is not uncommon among the porters at Covent Garden, and I have since seen another man from the Market with an exactly similar condition caused in the same manner.]

Case of Leishmaniasis.

By A. M. H. Gray, C.B.E., M.D.

This patient is an Indian student, who has been in this country a year. Six months ago a small pimple developed on the ulnar side of his left hand and later a similar one on his left knee. These have increased in size until at the present time he has in each area a dull red infiltrated plaque 2 to 3 in. in diameter with a small central crust beneath which is an ulcer. A scraping taken by Dr. Goodhart from the ulcer on the hand shows Leishman-Donovan bodies in large numbers.

No protozoa were found in the blood, while the cell-count is as follows: Red blood-cells, 5,500,000 per c.mm.; hæmoglobin, 90 per cent.,; colour index, 0·82, white blood-cells, 6,000; polymorphonuclear neutrophils, 43 per cent.; lymphocytes, 31 per cent.; large mononuclears, 8 per cent.; eosinophils, 17·5 per cent.; basophils, 0·5 per cent.

Section of Electro-Therapeutics.

President—Dr. G. B. Batten.

The Physico-chemical Action of Interrupted Currents in Relation to their Therapeutic Effects.

By W. J. Turrell, M.D.

Perhaps the greatest difficulty that the electro-therapeutist encounters, when he attempts to arrive at a clear conception of his subject, is the initial one of visualizing the relationship of electrical with chemical energy. This difficulty is increased rather than diminished by modern specialization, which tends to create unnatural and non-existent distinctions.

When considering the action of interrupted currents, we are met at the outset by a difficulty of this kind; for it is generally assumed that, in the so-called electrical stimulation of nerve and muscle, the muscular contractions are excited by the direct action of the electrical energy. In reality, the electrical action is indirect; for the contractions directly result from the chemical action of the hydrogen or hydroxyl concentration consequent upon the abrupt make or break of the circuit.

This distinction may at first sight appear unimportant: it is, however, of considerable importance, for we can visualize far more clearly the action of the various forms of interrupted currents, when we consider them in terms of hydrogen-ion concentration rather than in terms of voltage.

That muscular contractions are not directly excited by the electrical stimulation is shown by the fact that they occur at brief though measurable intervals. Moreover, Milnes has shown that if a skeletal muscle of the ray fish be treated with a dilute solution of ether, thus preventing the flow of ions or any variation in their concentration by electrical means, no contraction will follow an electrical stimulus; on the other hand a muscle so treated can be excited by the direct application of an acid or an alkali.

When an electrical circuit of, or beyond, a minimum strength and duration is abruptly established, or broken, or suddenly varied in strength, an unpleasant sensation is experienced and a muscular contraction is excited. At the make of the current this contraction invariably occurs only at the negative pole, and at the break of the current it takes place only at the positive pole.

These facts have been proved by the experiments of Cardot and Laugier (*Journal de Physiologie et de Pathologie générale*, Paris, 1912) which were based on the variation with the temperature in the velocity of excitation of a neuro-muscular system. Bourguignon (*Revue neurologique*, April 30, 1914) demonstrated this phenomenon more simply: thus, if we apply a small active negative electrode over the musculo-spiral nerve in the upper arm, and pass a cathodal closing contraction, the muscles in the forearm supplied by the musculo-spiral nerve will be excited. If, on the other hand, we employ an active positive electrode the biceps and only the muscles of the upper arm (irrespective of their nerve supply) in the immediate neighbourhood of the electrode will contract. In the former case there has been direct stimulation of the musculo-spiral nerve—a true K.C.C. In the latter case there has been no direct stimulation of the nerve, but an excitation of the muscles in the neighbourhood of the electrode by a "virtual" K.C.C. deep in the tissues.

It follows from these experiments that the old formula:—

K.C.C. > A.C.C. > A.O.C. > K.O.C.,

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is incorrect; for A.C.C. and K.O.C. do not occur, and the contractions attributed to them proceed from a virtual K.C.C. or a virtual A.O.C. deep in the tissues.

No explanation of the phenomena of the electrical stimulation of nerve and muscle can be satisfactory unless it explains the action of the "virtual" as well as of the terminal poles.

One fact of great importance in electro-therapy can be deduced from the existence of these virtual poles; namely, that at both make and break, stimulation takes place throughout the whole inter-polar path.

It appears to be generally agreed among physiologists that muscular contraction occurring at make is due to a sudden concentration of hydrogen ions, which is equivalent to an acid stimulation, for the strength of an acid is in proportion to its hydrogen-ion concentration. In regard to what takes place at the break of the current, views seem to diverge or to be indefinite.

For the lack of a more definite pronouncement by the physiologists we are compelled to fall back on a more or less tentative working basis, taking care that our hypotheses are not at variance with established physiological fact.

From the point of view of the electro-therapist it is the attractive rather than the repulsive action of electrical energy that is in evidence. When an electric circuit is established through an electrolyte, the positive pole attracts the negatively charged ions and the negative pole the positively charged ions.

Upon establishing such a circuit through the body, the hydrogen ions, being the lightest and the fastest moving, concentrate momentarily at the negative pole, causing an acid concentration which excites a muscular contraction; but almost immediately electrical equilibrium is re-established by a movement of the heavier and less mobile negative ions in the direction of the positive pole. This momentary concentration of hydrogen ions occurs not only at the negative pole, but is transmitted in the form of "virtual" poles throughout the whole of the inter-polar path; and it may be compared with the manner in which the tractive force of a railway engine is communicated in jerks to the successive wagons of a train. If the contraction at make is due to the momentary concentration of the light, easily moved hydrogen ions, conversely, at break, the momentum of the heavier, more slowly moving hydroxyl ions would cause a momentary excess of them at the positive pole. This would produce an alkaline stimulation at the positive pole extending back towards the negative pole and causing the establishment of successive virtual poles throughout the inter-polar path. We can again compare this phenomenon with the series of impacts of the wagons of a moving train when the tractive force of the engine has been cut off. This theory not only explains the excitation at make and break and the origin of virtual poles, but also helps us to realize why the contraction at make is more vigorous than that at break. The amplitude and vigour of a muscular contraction varies with the ionic concentration; this in turn varies with the voltage or tractive energy of the current, and with the rapidity or abruptness of the make or break. This concentration is only a momentary one, for ionic equilibrium is almost at once re-established both at the terminal and the virtual poles, and the higher the voltage the more rapid is the re-establishment of this equilibrium. The concentration is, however, continuously repeated whilst the voltage rises or falls. If, instead of employing an abrupt make and break, we make and break the current very gradually, there will not exist at any moment the ionic concentration necessary for exciting a contraction, and the higher the voltage, the more gradually must the current be applied and interrupted in order to ensure the absence of excitation.

These facts are well illustrated by the analogy of the flow of water. If we imagine a volume of water held back by a dam at a high level (high potential), it is clear that entirely different effects will be produced accordingly as we allow this

water slowly to trickle through the dam, or suddenly open a large flood-gate and allow the water to rush through with high velocity and great force. In the former case very little energy can be utilized, in the latter, the density or concentration of the energy is very high. These effects are analogous to the slow application of a source of high electrical potential, and to abruptly making or breaking the circuit. Of course, this analogy must not be pushed too far, for in the case of the water the force is propulsive, whereas in that of the electrical circuit there is the double force of the positive pole attracting the negative ions, and the negative pole attracting the positive ions; the main underlying action is, however, the same. And this principle applies: whatever source of electricity we use, whether dry cells, accumulators, a dynamo, condenser, or static machine, the concentration of the hydrogen or hydroxyl ions and the type of resulting contraction will depend upon the voltage and the abruptness of the make and break.

So far we have only dealt with the exciting agent, but of equal importance is the quickness of up-take in the receptor. This quickness of excitability is expressed by the "chronaxie," a term which we owe to the French physiologist, Lapicque. To find the chronaxie of a nerve or muscle, the weakest current, without regard to its duration, which will produce the faintest perceptible contraction is first ascertained. This current strength is termed the "threshold of excitation" or "single rheobase." Physiologists, in order to make their results more accurate, double this strength of current, thus obtaining what is called the "double rheobase." By means of a suitable instrument, the minimum time required to excite a contraction with this double rheobase is ascertained. This minimum time is the "chronaxie of Lapicque."

It is evident that a current must have a certain minimal strength or it will not excite a contraction: there must also be a certain minimal duration below which a current of minimal strength will not produce a contraction. If the minimum duration is reduced, no contraction will result unless the strength of the current is increased: and, as the duration is decreased, the strength has to be increased in a rapidly increasing ratio. The chronaxie of a healthy nerve has been found to be about $\frac{1}{1000}$ second, of a degenerated muscle about $\frac{1}{10}$ second, and involuntary muscle-fibre may require a stimulus lasting for a second or more.

The chronaxie of Lapicque, it should be remembered, only deals with weak stimuli. If the strength of the stimulus is enormously increased, as, for instance, by the aid of a spark from an X-ray coil or a powerful static machine, a contraction can be excited, even in a paralysed muscle, by a very brief duration of $\frac{1}{1000}$ of a second or less.

As the quickness of excitability varies so much, it is evident that the duration of the stimuli employed must similarly be varied. It would be useless, for instance, to apply a faradic stimulus with its time duration of $\frac{1}{1000}$ second in order to excite a paralysed muscle with a chronaxie of $\frac{1}{10}$ second, for no contraction could result. On the other hand, the quick chronaxie of a healthy neuro-muscular mechanism requires a very rapid make and break to secure the maximum effect.

This difference in the quickness of excitability between normal and abnormal neuro-muscular mechanism has been utilized by Lapicque to overcome the over-action of the healthy nerve and muscle under the indifferent electrode, when testing the chronaxie of the injured nerve and muscle stimulated by the active electrode. Lapicque, moreover, suggested in his original paper[1] that the method might be advantageously employed in electro-therapy. This technique of Lapicque has been extensively used in the electrical department of the Oxford Hospital, and has been found most valuable in the treatment of Bell's palsy, infantile paralysis, and other

[1] *Comptes Rend. Acad. de Science*, 1915, clxi, p. 643.

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similar conditions. Its main advantages are its selectivity, and, owing to its gradual onset, its painlessness. It entirely removes the objection, sometimes made, that healthy muscles are over-stimulated when treating the less excitable, paralysed ones. By this method it is possible to suppress entirely the excitation of these opposing muscles.

This result is achieved by using a current, interrupted by a metronome and regulated by a water resistance, with condensers in parallel varying from a capacity of 2 m.f. to 30 m.f. At make, a progressively decreasing current is diverted from the patient to the condensers ; when they become fully charged the whole of the current reaches the patient. At break, the condensers discharge in the opposite direction to the current at break and thus render it a gradually decreasing one instead of a sudden abrupt discharge. The apparatus required is so simple and inexpensive, and the effects are so useful, that this method ought to be more widely known and more generally employed. Pain is so entirely subjective, some patients describe as intolerable a current which others experience as a pleasant sensation, so that it is much more difficult to explain the causation of the pain than to visualize the mechanism of muscular excitation. Pain is, moreover, often largely due to the high resistance of a dry skin, and a current, which when first applied is very irritating, frequently excites no discomfort as the skin resistance diminishes after a few minutes' treatment.

As a general rule, the pain depends, like muscular excitation, upon the ionic concentration, and this is proportional to the voltage. Thus the pain is greater when a high voltage is applied from a secondary consisting of many turns of fine wire, than when a current is applied from a secondary of fewer turns of coarse wire. But, on the other hand, when a very rapidly interrupted current (1,000 per second) is employed, a powerful muscular contraction results and little or no discomfort is caused.

In this case the briskness of the interruption causes sufficient concentration at a much lower voltage than would ordinarily be required and the excitation is consequently less painful.

From this it would appear that the quickness of excitability is more rapid in a peripheral motor nerve mechanism than in the central mechanism of a sensory nerve. It would follow from this that, when employing the faradic coil, we can obtain the most efficient contractions accompanied by the minimum of discomfort, by the use of currents interrupted at very high speed. There is, however, a limit to the extent to which rapid interruption can be utilized : for the tetanic contraction excited, made up as it is of a variation in muscular tension at each interruption, has a most fatiguing effect on the muscles, as the electro-therapeutist can readily appreciate by applying to his own muscles a current interrupted in this manner.

The comparative painlessness of condenser discharges appears to be due to the minute amount of electricity in these discharges, for a condenser cannot discharge more electricity than it can contain ; and the capacity of the condensers employed in electro-therapy is exceedingly low.

In the Morton wave current, though it produces, owing to the abruptness of its discharge, a very powerful muscular contraction, the amount of electricity is exceedingly small, and any pain or discomfort which the patient may experience is due to the force of the muscular contraction and not to any stimulation of the sensory nerves by this discharge. In the administration of the Morton wave current, the patient is, as it were, one coating of a condenser, and the amount of electricity set free at the discharge across the balls of the machine is limited to his capacity—an exceedingly small quantity. The comparative painfulness of the static spark is explained by the fact that, in addition to any other sensation, there is the added force at the point of discharge of the electrically charged particles attracted to the patient

from the earth current. From our experience of the action of condenser stimuli we are again led to infer that, when using a very small amount of current (the threshold of excitation), the quickness of excitability is greater in motor than in sensory mechanisms.

In the application of alternating currents a frequency can be reached at which the hydrogen-ion concentration at make is neutralized by the hydroxyl concentration at break, and vice versa, before either concentration has time to become effective. The frequency at which this result occurs depends upon the voltage: the higher the voltage, the higher is the frequency that is necessary to abolish muscular excitation and sensation.

In his original paper on high-frequency currents, d'Arsonval[1] states that, until 2,500 to 5,000 excitations per second are reached, the vigour of the contractions was increased in proportion to the rise in frequency; but at about the frequency mentioned the force of the resulting contractions began to diminish. When he first commenced his experiments in the year 1888 he had no means by which he could raise the frequency beyond this point. Two years later, by employing the wireless apparatus of Hertz, he was enabled to obtain a frequency of about a million oscillations per second. At this frequency all sensation and all muscular contractions were abolished, and the true clinical high-frequency currents were for the first time obtained. In the early machines the spark gaps functioned between points at a separation of an inch or more; this wide gap necessitated a very high voltage to overcome the resistance, so that with many of the early machines sensation and muscular twitching still persisted on the direct application of the current. In fact, in some modern machines in which a powerful induction coil is employed to raise the primary voltage, some sensation and a faint muscular twitching are experienced.

In a well-designed modern machine, however, a different type of step-up transformer is employed, yielding a lower voltage; wide discs, only separated by one or two millimetres, are substituted for points in the spark gaps, and in this way a higher amperage at a lower voltage is obtained with a total abolition of all contraction and sensation. Thus, though the frequency of the apparatus depends solely upon the capacity of the condensers and the inductance, this frequency must be increased in proportion as the voltage is raised, if all muscular contraction is to be prevented. Hence the relation of the frequency to the voltage is an important factor in the efficiency of a high-frequency apparatus.

According to modern views, there is a distinct difference in the therapeutic effects obtained from the older type of high-frequency apparatus and those yielded by the higher amperage and lower voltage of the modern diathermy machines. It is necessary, therefore, to distinguish between the two types, and it is advisable to adopt the teaching of Bordier and apply to the former the term "high-frequency currents of tension," and to the latter the term "high-frequency currents of quantity." In certain cases, such as those of hyperpiesis, better results appear to be obtained from the use of high-frequency currents of tension than from those of quantity. In other cases, however, the high-frequency currents of quantity are the more beneficial owing to their greater heating action. With the high-frequency currents of quantity a sensation only of heat is experienced by the patient, but with high-frequency currents of tension, a faint sensation not necessarily unpleasant—usually described as a faint faradic sensation—is felt, and this is accompanied by faint muscular twitching almost fibrillar in character. These effects are due to the ionic concentration, which has not been completely neutralized by the concentration of opposite charge. It is difficult to imagine that currents differing to this extent in their physical action should not also differ in their therapeutic effects.

[1] d'Arsonval, "Action physiologique des courants alternatifs à grande fréquence," *Archives de Physiol. norm. et. path.*, 1893, 5e Sér. v, p. 789.

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Rectified High-frequency Currents.

A most interesting paper by MM. J. Cluzet and J. Chevalier recently appeared in the February number of the *Archives de Electricité médicale*[1] on the action of rectified high-frequency currents. Two methods of rectification by means of radio transmitting valves were employed. Four valves were arranged, in the one case in series, in the other in the form of the Wheatstone bridge. In the former case the rectification took the form of merely suppressing one half phase of the oscillations, in the latter the whole of the oscillations were truly rectified into unidirectional oscillations. The physiological effects were found to be identical in the two cases, consequently the more simple method of arranging the valves in series was adopted in the authors' experiments.

These rectified H.F. currents are capable of being measured by a d'Arsonval galvanometer, of exciting electrolysis, of charging condensers, and of exciting an X-ray tube. The authors found that, in the process of rectification, there was practically no loss of voltage whether measured across an open arc or through the closed circuit of the patient.

Experiments were conducted at a relatively low voltage by employing a diathermy apparatus, at a higher voltage by the use of a powerful X-ray coil to step up the primary voltage, and at a still higher voltage by the addition of an Oudin resonator.

A very strong tetanization is obtained from these rectified H.F. currents, but it is not painful, and it is stated that it can be continued for more than ten minutes without fatiguing the muscles.

The motor and sensory effects vary with the voltage; when employing the high voltage from the Oudin resonator a contraction was excited with 0·2 m.a., as strong as that obtained with 2 m.a. from the lower voltage of the diathermy machine.

In experiments conducted on the sciatic nerve of a guinea-pig four hours after death, the following results were obtained:—

Faradic inexcitability. Galvanism 10 m.a. H.F.R. (H.T.) 0·5 m.a. H.F.R. (L.T.) 2 m.a.

In cases of peripheral nerve paralysis, the following results were obtained:—

(1) Inexcitable to a galvanic current of 15 m.a.
A definite reaction with 0·75 m.a. H.F.R. (H.T.).

(2) Inexcitable to galvanism.
A very definite reaction with H.F.R. (H.T.) 0·6 m.a.

In one case, however, that of a very old infantile paralysis, the patient failed to respond to H.F.R. (H.T.); there was also no response to any other form of stimulation. In these cases when employing H.F.R. (L.T.) ten times the strength of current was required to excite a contraction.

These results are in full accordance with the views on ionic concentration expounded above, for the results are such as might have been foretold by the application of the theory. That is to say, with a sufficiently high voltage and a sufficiently rapid make and break the density of ionic concentration is so high that a muscular contraction can be excited with a minimum of current.

Definite proof is, moreover, yielded by these crucial experiments that the failure of the ordinary H.F. currents to excite muscular contraction is not the result of the frequency of the interruption, but of the rapidity of the alternations, which does not permit of the chemical action of one phase of the current before it is neutralized by the opposite phase.

There is, indeed, only one result from these experiments that we should not have anticipated, namely, the little muscular fatigue induced by ten minutes' tetanization at this frequency. If this absence of fatigue is absolute, and is not attributable to the endurance and enthusiasm of the investigators, it can only be explained on the

[1] *Arch. d'Electr. méd.*, 1926, xxxiv, p. 65.

ground that with very high frequencies the variation in muscle-tension, which must occur at each stimulus, however frequent, is so slight that its effect in producing fatigue is negligible.

These experiments were conducted with H.F.-damped oscillations; it would be very interesting to know whether identical results would be obtained from the undamped continuous oscillations of H.F. It is possible that the "period of silence" between each series of damped oscillations has some effect that would be absent when undamped oscillations were employed.

ACTION ON INVOLUNTARY MUSCLE AND TISSUES OF LOW EXCITABILITY.

Although many special forms of current at varying rates of interruption have been designed and recommended by electro-therapists for exciting contraction in the involuntary muscles of the bowel, the fact nevertheless remains that the involuntary muscles of the stomach and intestines are incapable of excitation by any of the currents employed in electro-therapy. Several causes may contribute to this. In place of the simple excitatory mechanism of voluntary fibres, we have in the intestines a double mechanism of excitatory and inhibitory nerves: in place of the simple contraction of voluntary muscle, we have the peristaltic movement of the intestinal muscle communicated from fibre to fibre: and, finally, in the abdomen we have a wide area for diffusion of the current in place of the relatively circumscribed area of a limb.

It would be possible by applying the electrodes directly to the musculature of the bowel, after a preliminary laparotomy, to excite contractions in these involuntary muscles. But even then a very strong stimulus lasting for some seconds would be needed, and the resulting contraction would take the form rather of a local constriction of the bowel than of a promulgated wave of peristalsis. For, though very strong currents directly applied to the intestinal walls cause some diffusion of the contraction to neighbouring fibres, the contraction will always predominate at the section stimulated.

This absence of response in the intestinal muscles is, perhaps, fortunate, for otherwise the intestinal colic that would be excited would render incapable of administration such electrical treatments as those for obesity, and those for restoration of tone in the abdominal muscles.

It is, however, possible to treat indirectly by electrical means certain forms of chronic constipation with considerable success. For the rhythmic pressure and increase of tension produced by the excitation of slowly surged contractions in the abdominal muscles will doubtless stimulate peristalsis. Again, by the restoration of tone to the abdominal muscles the cause of constipation in enteroptosis may be entirely removed.

Interrupted currents exercise no appreciable action on the larger blood-vessels, but the clearly beneficial effects produced by application of a suitably surged current on cold and œdematous limbs, are probably due partly to the stimulating action on the walls of the arterioles by the electrically induced hydrogen and hydroxyl-ion concentration. This effect on the arterioles is probably of a similar nature to the action of contrast baths on the more superficial arterioles—an action which is well expressed by the term, suggested by Sir Robert Jones, "gymnastics of the arterioles."

It is difficult to say to what extent the beneficial effects of electrical stimulation of tissues of low excitability are due merely to the increased blood-supply, and to what extent they may be due to a direct stimulation of the tissue cells.

The heart's action appears to be extremely sensitive to interrupted currents of even low intensity when administered through its area, for several deaths are stated to have occurred in Germany from the application of interrupted currents of such

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low intensity as are obtained from machines of the pantostat type. Fibrillation of the cardiac muscle is said to occur in these cases, and may be the result of interference with the cardiac rhythm by these currents. The muscle of a frog's heart can be stimulated to rhythmic contraction by direct application of the constant current to the cardiac muscle. The make of the current is supposed to start a beat, then the refractory period occurs and the cardiac muscle becomes inexcitable; when this period has passed, the heart muscle is again stimulated by the current; thus a rhythmic contraction may be excited in the heart by a current of unvarying intensity. This paradoxical effect may be due to a variation in electrical resistance during the refractory period, causing a corresponding variation in the ionic concentration which excites a contraction of the cardiac muscle.

In electro-therapy a constant current or an interrupted H.F. current may safely be administered through the cardiac area; but the application of interrupted currents of low frequency should be avoided in this region.

THE THERAPEUTIC ACTION OF INTERRUPTED CURRENTS ON SENSORY NERVES.

The sedative effects of the thermic currents of diathermy in the relief of pain, by the relaxation of spasm and tension, are too evident and too well known to need detailed consideration.

The most interesting and remarkable of the interrupted currents of low frequency are the Leduc currents. The Leduc interrupter is an instrument which admits of the interruption of the galvanic current up to 200 times a second, the best results being obtained at about half that rate of interruption. It is claimed that by employing this form of interruption it is possible "to produce gradually with remarkably weak currents single contractions, tetanus, local anæsthesia, general anæsthesia, paralysis of the respiration, of the heart, and ultimately death."

Leduc claims to have produced all these results when experimenting on animals, prolonging the anæsthesia for eight hours in some cases without any bad effect following. He has also, when experimenting on himself or his assistants, produced general anæsthesia and "electric sleep." The intensity of the current does not exceed 3 milliamperes, and the potential is not more than from 10 to 20 volts. The anæsthesia thus produced, whether local or general, appears to be due to an overfatigue of the sensory end-organs in the one case and of the brain cells in the other. The local anæsthesia is in many respects identical with that obtained by rapidly and repeatedly percussing a skin area. These currents are useful in the treatment of certain forms of neuritis. In causalgia it far surpasses all other forms of treatment, relieving for several hours the terrible pain with such certainty as to possess even a diagnostic value.

With the moderate intensity of current applied in electro-therapy no appreciable action on such nerves as the vagus is usually recognizable. But when the very powerful currents of industrial electricity are accidentally applied, or when a lightning stroke is received, very powerful ionic concentrations at make and break with the constant current, and of a recurrent character with interrupted currents, take place in the form of virtual poles throughout the body, which by their action on the vagus may inhibit the action of the heart or respiration. As Jellinek points out, this is at first only a condition of "apparent" death, but unless artificial respiration is quickly practised the condition rapidly passes into real death.

ON THE CHOICE OF METHOD.

Any method selected for electrical stimulation must naturally be that which excites the required amount of stimulation with the minimum of pain.

For overcoming the hypertonus of the lumbar muscles associated with lumbago, no other method will yield the speedy and complete relief which is obtained from

the Morton wave current of the static machine. The force and painless character of the contractions excited by this method should lead to its adoption for breaking down peri- or intra-muscular adhesions in the case of sprains and other injuries, and also for the rapid diffusion of the fluid in acute synovitis of the knee-joint.

For the restoration of muscular tone—a category which covers a very wide and important range of cases—no other procedure equals in its results those obtained from the use of the surged faradic current in accordance with the plan introduced by Dr. Morton Smart. The importance and special value of this treatment call for some further consideration of its mode of action. The value of the treatment is perhaps most clearly seen in cases of loss of muscular tone following the tearing of a few muscle fibres in cases of rider's strain. In these cases, although the actual lesion may be a very slight one, producing no physical signs beyond some tenderness at the seat of the lesion, yet the muscle tone is found to be almost completely lost in the group of the three adductors, their electrical excitability is much reduced, and adduction of the affected thigh, such as gripping a horse, causes sufficient pain to lead to a speedy abandonment of such movement. With no treatment other than rest and bandaging, the condition is prolonged for months, and ultimately it is necessary to adopt some supporting instrument to overcome the pain induced by horse riding.

In the treatment by the Morton Smart method of these and similar cases, such as loss of tone in the quadriceps muscle following injury to the knee-joint, the condition of the muscles improve far more quickly than would be anticipated or than can be accounted for by a simple restoration of strength due to a re-development or regeneration of muscle tissue.

Hitherto it has been difficult to explain this speedy recovery. A possible explanation can, however, be deduced from the recent experiments of Dr. E. D. Adrian[1] on the action-currents produced by sensory nerve endings. By means of an extremely delicate electrometer capable of reacting to a potential variation of 0·01 millivolt lasting for $\frac{1}{1000}$ of a second, Adrian was able to record the passage of action-currents

"accompanying afferent impulses in the sciatic nerve of the frog when the gastrocnemius is stretched by a weight, in the cat's saphenous nerve when the skin is pinched, in the vagus of the cat and the rabbit when the lungs are inflated, and in the cardiac depressor nerve of the rabbit with each heart beat."[2]

"Impulses are started from different sense organs irregularly. A single end-organ, however, responds to a continuous stimulus with a regular series of discharges. Their frequency varies from 5 to 100 a second."[2]

The law of "all or nothing" is found to apply in these experiments, for each stimulus is a maximal one; the frequency of the action-currents varies, however, with the strength of the stimulus. When the muscle is lightly loaded and is comparatively slack, stimuli still pass up the nerve at a frequency of about 3 to 8 per second. It has been suggested that such stimuli are the basis of tone in voluntary muscle.

It might further be argued, that when a muscle had lost its tone from injury to its fibres or to a joint with which its action is associated, these afferent stimuli in the sensory nerve would be slight or absent. And, as time went on, from the absence of such stimuli a further loss of tone in the muscle would occur and would tend to be increased by too long rest or splintage of the affected part. Thus, a vicious circle would be established which would fully account for the lack of recovery in tone in the muscles of injured limbs which have been too long treated by rest and fixation.

1 *Journ. Physiol.*, 1926, lxi, Nos. 1 and 2.
2 *Brit. Med. Journ.*, 1926, i, p. 1000.

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By the strong, graduated contractions excited by the Morton Smart coil, stimuli are applied to the muscle tendon, which in turn set up these action currents, and in this way rapid restoration and maintenance of muscle tone can be rationally accounted for.

For the relief of nearly all forms of pain, the method of choice is unquestionably the diathermy current. The chief exception to this rule is the relief of that peculiarly painful condition known as causalgia, in which diathermy exacerbates the heat-pain, and for which the Leduc current acts as a specific.

For the excitation of weak, painless, and slow rhymthic contractions, and for the stimulation of tissue of low and slow excitability, the surged Watteville current is indicated. This form of treatment is useful for the restoration of tone in muscles which have become flabby as the after-effect of sciatica or neuritis, when the more vigorous contractions excited by the Morton Smart coil are perhaps too powerful. It is also most useful in the resolution of the indurated œdematous conditions following phlebitis and associated with "white leg," and also for exciting tissue stimulation in chilblains and allied conditions. The special physical properties of this current are due to the prolongation of the period of excitation.

Perhaps our terminology or our mode of expression may be misleading, for when we speak of the excitation of muscular contraction being due to a sudden concentration of hydrogen or hydroxyl ions, we do not mean that this is a sudden isolated concentration, but that it is a continuously recurring concentration lasting while the voltage is abruptly rising or falling; and that it is due to the continuous arrival of fresh "parcels" of hydrogen or hydroxyl ions, whilst previous parcels have been or are being neutralized during this period of varying voltage. In the break current of the faradic coil this concentration is condensed into about $\frac{1}{1000}$ of a second, in the Watteville current it may extend to $\frac{1}{50}$ of a second or more.

The Watteville current, strictly speaking, implies the combination of the galvanic current with the faradic, but the term is also applied to combination of the galvanic with the sinusoidal current, and in this latter form it is the more useful for the excitation of tissues of low excitability, owing to its more prolonged wave of excitation. The addition of the galvanic current to the sinusoidal increases the voltage of the combined current, but the prolongation of the wave of excitation thus obtained is the more valuable effect of the combination. With this current a condition is produced very similar to that which occurs with the selective galvanism of Lapicque, in which the prolongation of the wave of stimulation is more favourable to the excitation of muscles with a slow, than to those with a quick, chronaxie.

The type of muscular contraction produced by the Watteville current is more wave-like and less abrupt than that produced by a sudden make and break of the current, and this slower type of muscular contraction is more suitable for certain purposes, such as the stimulation of the abdominal muscles in the treatment of constipation and in the dispersal of œdema from the limbs.

The resulting waves of muscular contraction are not, however, so dependent upon the type of the isolated stimuli as upon the manner in which the tetanic contractions excited by rapid repetition of these stimuli are applied. The current exciting these tetanic contractions must be gradually surged on and off, allowing sufficient time between each tetanic contraction for an adequate period of rest. It is also well to select a surger which will reverse the polarity of the galvanic component at each alternate group of contractions; in this way all risk of an electrolytic burn will be avoided.

Administered in this manner, the Watteville current is one of the most useful employed in electro-therapy.

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Another Theory of the Action of Interrupted Currents.

A theory has recently been put forward:—

"That each of the various body organs is stimulated or acted upon most effectively by an electrical current of one certain specific frequency is a fact which gradually is being recognized more and more."

And it is stated that

"there is therefore a distinct basis for the corollary that each individual organ or structure responds to a definite frequency or rhythm of electrical stimulation.

"For the purpose of a convenient division of the subject, it is advantageous to designate those currents which act specifically upon the viscera and the neuro-muscular system as low-frequency currents, and to reserve the term high-frequency currents for those which act upon and influence the cells and their functions."

This theory appears to originate from a false analogy with waves in the ether, set up by X-rays, or ultra-violet radiation, or a spark discharge, which actuate when they fall upon bodies of similar resonance. It also suggests a repercussion from the heresy of the "Abram box," and is strongly reminiscent of the famous "Shearer hoax" in the Great War: for the basic supposition underlying both these fallacies was the superposition, by means of an electrical current, upon the specific frequencies actuating the various tissues and organs, of vibrations of similar frequency or wave-length.

That these action-currents do actually exist in the body is clearly shown by the far-reaching experiments of Adrian. But the frequency of these currents varies according to the strength of the stimulus with a variation from 3 per second at light load to 100 per second at full load. With such a wide variation of frequency there can be no distinct basis upon which to regulate the frequency of the externally applied stimuli.

By means of electrically excited contractions we can no doubt originate these action currents indirectly through the intrinsic and intricate nervous mechanism of the body; but we are certainly not justified in assuming, in the present state of our knowledge, that we can directly influence the frequency of this mechanism by any adjustment of the frequency of electrical stimuli applied externally to the body.

There is, on the other hand, an immense field of research open for investigation as to the relation between the application of external electrical stimulation and its indirect influence on the various organs and ductless glands of the body. There is already much evidence of the existence of such a relation to be deduced from the constitutional effects of such different agents as ultra-violet radiation and the static charge.

The best results in this connexion can only be obtained by the whole-hearted co-operation of physiologists, physicists, biophysicists, and biochemists, with those engaged in the actual administration of these therapeutic agents.

Discussion.—Dr. E. P. Cumberbatch said: The subject of Dr. Turrell's paper is one of no little importance. It is only by knowledge of the primary changes in the tissues affected by electrical currents that any scientific advance can be made in electro-therapeutics. The *thermal* changes produced by high-frequency currents are known, as also are some of the *chemical* changes produced by the galvanic current. The immediate effects of interrupted currents are uncertain and difficult to demonstrate, but the theory explained by Dr. Turrell may well lead to their elucidation.

Comment might be made on the supposed difference in the effects of high-frequency currents at *high* tension and of similar currents at *low* tension. Both produce heat in the body, the latter more than the former. The physiological and therapeutic results in each case can be attributed to *heat*. The supposition that they may be due, in part, to some other action involves the subject in obscurity. No one can say precisely what this other action is, and it

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is wiser, in my opinion, to adopt the more rational explanation when prescribing and administering high-frequency therapy. If the high-frequency currents of high tension procure fibrillary contraction of the muscles they are misnamed. High-frequency alternating currents do not stimulate the excitable tissues.

The use of rectified high-frequency currents begins a new chapter in physical therapeutics. Treatment by combined heat and muscular exercise should be very useful in paralysis. It is indeed surprising that Cluzet and Chevalier were able to tetanize their muscles for many minutes without fatigue.

As Dr. Turrell pointed out, it does not seem possible, with the currents at our disposal, to stimulate involuntary muscle to contract. This may be because we cannot place our electrodes close enough to the organs containing muscle of this kind. Another reason may be that involuntary muscle is supplied by nerves conveying both augmentor and depressor impulses.

The experiments of Dr. Adrian, to which Dr. Turrell referred, are most suggestive. It is quite likely that the stimulation of the nerve-endings in the skin, when the latter is traversed by interrupted currents, has a *reflex* influence on the voluntary muscles, and perhaps on the unstriated muscle of the blood-vessels and alimentary canal, and on the endocrine organs. Whatever the mechanism of the stimulation there is no doubt that certain bodily functions are influenced. The full-length sinusoidal bath is followed by a lowering of the basal metabolism. Stimulation of the skin, especially by the brush discharge, is followed by a rise of blood-pressure due to constriction of the arterioles. Similar stimulation will often cause a return of menstruation in cases of amenorrhœa. It is possible, in these cases, that the internal secretion of the ovaries is reflexly increased by the stimulation of the skin and the end-organs of the nerves. It is by the study of the physiological action of electric currents on the normal subject and on animals that the relation between the application of electricity to the patient and the production of therapeutic effects will be ascertained. In this way electro-therapy will progress still further from empiricism to science.

Dr. C. A. ROBINSON said: It is a great help to the practical electro-therapeutist to be able to visualize the events which follow the application of electrical current to the tissues. The mental picture should, however, be as correct as possible. I do not wish to quarrel with Dr. Turrell for putting forward the hypothesis of the hydrogen ions, but it must be admitted that the movement of the hydrogen ions is only a very small part of what occurs when muscle or nerve is electrically stimulated.

How difficult it is to form a correct view of the events may be realized if we consider that we do not know the ultimate ionization of such a simple electrolyte as a drop of tap water. Blood-plasma consists of a solution of many salts. The presence of proteins and other colloids complicates the state of ionization. On the surface of the colloid particles adsorption compounds are constantly forming and breaking up. Variations of osmotic pressure and surface tension at the numerous interspaces are taking place. Added to this, again, is the complexity, as an electrolyte, of the cells and the dozen or so different enzymes they may contain, each of which is itself a complex substance. The whole is subjected to the influence of the hormones from the internal secretory glands. This complex arrangement is in a constant state of turmoil. What happens when an electrical current is passed through it is not within human knowledge. It is a little unsatisfying to think of it only as a movement of hydrogen and hydroxyl ions. Fortunately for us as practical electro-therapeutists it does not matter. What is necessary for us is to apply the currents and observe the effects.

Although I do not wish to underrate the value to us of the work of physiologists, I feel very strongly that advances in our speciality will come in the future, as they have in the past, by clinical observation of the effects of electrical application by people who are capable of correct deductions from the facts obtained.

From time to time attempts have been made to devise a method of muscle-nerve testing which would eliminate the personal factor in the investigator. Simple condenser testing is inaccurate. The method of expressing the excitability of the muscle by the chronaxie of Lapicque gives accurate results. The chronaxie is the time factor concerned in the quantity of electricity used to produce a contraction. By finding the rheobase a standard for the particular experiment is obtained. On doubling the voltage necessary to obtain the rheobase the time during which current has to pass to produce contraction is the chronaxie.

The advantage of thus having the condition of the muscle expressed by a figure is that comparisons may be made between one case and another, and variations of the condition of

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the muscle in a patient may from time to time be compared. The technique is, however, elaborate, the instrument required is complicated, and the time occupied in obtaining an estimate is long. The method introduces fallacies, so that the personal factor of the operator is not eliminated. As a matter of fact the older method of testing, by means of make and break of direct current and faradism, in the hands of an expert such as Dr. Cumberbatch, is more reliable than any other in the hands of a less experienced exponent. Up to the present no method so far introduced does away with this personal factor, nor is it likely that there will ever be one that will do so.

Dr. JUSTINA WILSON: With regard to the effect of alternating currents on the cardio-vascular system: their application is attended with little, if any, risk. In the fatal cases reported from Germany, and alluded to by Dr. Turrell, the current was applied directly to the chest wall, and most of the patients were suffering from fairly advanced myocardial change. There is no risk if the currents are applied in total or partial baths. The effects, briefly summarized, are the following: (1) That of temperature, which is more energetic in the whole bath than in the partial or "Schnee" bath. (2) Stimulation of the skin. Like the CO_2 bath, the sinusoidal bath stimulates the sensory nerve-ends and has a far-reaching effect on the circulation.

Such distinguished workers as Groedel, of Nauheim, and Romberg, of Munich, state that the results of CO_2 and sinusoidal baths are practically the same. They cause a slight contraction of the peripheral circulation. The splanchnic arteries and arterioles which are directly under the water dilate, but their dilatation is less than the peripheral contraction, so that there is a slight rise of blood-pressure which lasts from a quarter to half an hour after treatment. This is often desirable, but when not desirable it can be avoided by careful technique, i.e., putting the patient into the bath at a slightly raised temperature above the ordinary. When one is satisfied that the blood-pressure has been reduced under the influence of temperature the current is introduced.

The effects of the baths are the following:

(1) The pulse is slowed and its amplitude is increased, less in the sinusoidal than in the CO_2 bath.

(2) The output, i.e., volume per beat, is increased, and more so in the sinusoidal bath.

(3) Respiration is slowed and deepened. This is important in cases of venous congestion.

(4) Slight contractions of the thigh and back muscles are aroused, but the clinical effect of these is unimportant.

(5) Arrhythmias are influenced, especially ventricular extra-systoles of an extrinsic kind.

(6) The electro-cardiogram is influenced, that is to say: (*a*) The resting time of the heart is increased; (*b*) T. in the first lead, which responds to the contraction of the pulmonary base, is increased in amplitude; (*c*) T. in the second lead, which responds to the contraction of the aortic base, is also increased in amplitude, and (*d*) R. in the second lead, which responds to the contraction of the right ventricle, is increased in amplitude.

(7) The main value of these baths consists in the fact that they give the heart-muscle exercise without inducing fatigue. As Schott, of Nauheim, described it, they constitute the "gymnastic exercise of the heart" and are a valuable therapeutic agent, since they can be modified and controlled by careful observation of pulse-rate, blood-pressure, and respiration, before and after. As long as they are under the direction of an experienced physician, and the heart-muscle is capable of response, and the patient is able to give in to the treatment, and rest, they are distinctly useful.[1]

The baths have their use in valvular disease also. In mitral cases the muscle of the right ventricle is better filled and better stretched, therefore the contractions of the left ventricle are more vigorous.

They are peculiarly useful in aortic cases which depend largely on their vasomotor tone, the expression of which is the raised blood-pressure and the thickening of the elastic and muscle fibres of the media throughout the vessels.

They also appear to act beneficially on the vasomotor system, and in many cases of arterio-sclerosis so long as calcification is not present, and the nutrition and response of the skin are still factors to count upon. They increase the general vasomotor tone and the power of

[1] Hornung and Smith, who introduced these baths, state that through their use a pathologically enlarged heart is decreased in size, but careful study by means of the orthodiagraph has proved this statement to be without foundation.

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the circulation to adjust itself to circumstances such as sudden changes of position and to alterations in temperature.

I have found them of even greater use than diathermy in treatment of intermittent claudication.

Dr. TURRELL said (in reply to Dr. Cumberbatch) that the occurrence of sensation and muscular twitching during the administration of H. F. currents was dependent on the relation of the voltage to the frequency. At a very high voltage in the primary, such as was obtained from a powerful X-ray coil, both muscular twitching and sensation would occur, but these were absent with the lower voltage obtained from the usual step-up transformer, although the frequency might be the same in the two cases. In his own experience he had found a distinct difference in the results obtained from the two types.

In reply to Dr. Robinson, Dr. Turrell said he could not agree with the attitude which Dr. Robinson took up in regard to the impossibility of visualizing the action of interrupted currents. The problem before the electrotherapist, who dealt with large currents of known voltage, from 2 to 60,000 volts, applied externally to the body, was a far different one from the complex problem which faced the physiologist dealing with currents of a fraction of a millivolt, of uncertain origin, and complicated by synapses and other intrinsic phenomena.

He did not regard the interrupted currents as "passing through the cells;" on the contrary he considered that the cells were protected by their lipoid films or by some other means from the action of the currents, and in this way he explained the fact that the normal electrical processes of the body were not interfered with or suppressed by the externally administered currents. Owing to the relatively high velocity of the hydrogen and hydroxyl ions in the electrolyte with which the tissues were bathed, the slower tissue ions played little or no part in the action of interrupted currents.

In reply to Dr. Justina Wilson's remarks, he said that his own experience in the treatment of heart cases had been confined to the treatment of "flabby hearts," in which he had found the electrically provoked exercises of Bergonié most beneficial.

Section of Obstetrics and Gynæcology.

President—Dr. ARCHIBALD DONALD.

Endometrioma of the Ovary.

By A. LOUISE MCILROY, M.D.

THE specimen is a right ovary with a small cavity about 1 in. in diameter, which contained tarry, chocolate-coloured fluid. It was removed from an unmarried woman, aged 36 years, who had complained of violent pain in the lower abdomen for the last seventeen months with sickness at intervals of three months. The pain had no special reference to menstruation or the mid-menstrual period. It lasted for about one hour and was followed by exhaustion. Menstruation was of normal type but the patient was uncertain about the occurrence of pain.

On examination there was a distinct tender swelling in the posterior vaginal fornix, related to the wall of the uterus. The patient menstruated after admission and experienced considerable pain and looked ill. At operation (abdominal section) the right ovary was found to be the size of a tangerine orange, cystic and adherent to the posterior wall of the uterus. In the process of separating the adhesions the largest cyst ruptured at its thinnest portion and the thick contents were extruded. As it appeared to be an endometrial growth the whole ovary was removed, together with the appendix, which showed pathological changes.

The left ovary and both tubes were congested but otherwise normal; the peritoneum was healthy.

The patient declared herself well and free from pain after the operation.

On examination the specimen shows a small, deeply congested ovary with cysts in its walls. On incision, the larger cyst or cavity shows a shaggy lining of blood-clot. After microscopical examination of sections from the wall of the cavity Professor Dible confirmed the diagnosis of endometrioma. The sections show typical endometrial glandular tissue but no great invasion of the ovarian stroma.

I am much indebted to Professor Dible, Director of the Pathological Department of the Royal Free Hospital, for his help and interest in the diagnosis of these specimens.

Some Important Differences in Gynæcological Practice.[1]

PRESIDENT'S ADDRESS.

By ARCHIBALD DONALD, M.D.

IT is only quite recently that it was suggested that I should open the proceedings of my year of office by a short address. On such short notice it was impossible for me to prepare a paper on scientific lines suitable for the occasion, but it has occurred to me that it might be of interest to draw attention to some differences in our practice which seem to be important. By doing so I thought I might stimulate inquiry into problems that are not yet solved. These differences may be noticed amongst individuals in any district, but there is a tendency for them to occur in geographical groups. In Manchester there is a certain individuality. There are divergences in practice from what is commonly taught and practised in other schools. I shall briefly mention some of these.

[1] Some remarks on the earlier history of gynæcology in Manchester have been omitted.

2 Donald: *Important Differences in Gynæcological Practice*

(1) The Treatment of Prolapse by Vaginal Plastic Operation only.

At one time it was believed that it was impossible to cure prolapse in this way and there is still scepticism on the point. I think I am not claiming too much for our school when I say that Manchester has been the chief advocate of these operations and that it is due to this fact that they are so widely employed. As far as I can ascertain, the first serious effort in this country to cure cases of bad prolapse in this way was made at St. Mary's Hospital, Manchester, in 1888. The technique in this early case—a description of which is to be found in the hospital records—was much the same as it is to-day. The essential features were the raising of thick and wide flaps from the vaginal walls and the suturing-in stages, the deeper tissues being brought together by continuous catgut, which was then covered over by stitching the mucous membrane. The operation is now so well known that it is unnecessary to say more about it.

(2) Curettage.

I believe I am right in saying that curettage is relatively more frequently performed in Manchester than elsewhere. There are still many who believe that the operation is unnecessary and even harmful in the cases for which we employ it. Our practice is, I submit, a logical outcome of the true pathology of many uterine troubles.

Amongst the most common symptoms with which the gynæcologist has to deal are painful or profuse or long continued or irregular bleeding and leucorrhœa. These symptoms are evidences of disturbed uterine functions. It is common to find more than one of them in the same patient.

(i) The only kind of dysmenorrhœa that concerns us here is that in which pain is caused by excessive or irregular uterine contractions. The pain is so severe as to cause complete disablement. It is often accompanied by nausea or sickness. It generally begins just before or at the onset of the period, and only lasts for a few hours. We curette in these cases because we regard the pain as due to some abnormality of the endometrium. This may be a hyperplasia of the glandular elements or some change in the stroma, either of which may render the process of menstruation more difficult, as each of them call for increased effort on the part of the uterine muscle. An interesting paper which corroborates this opinion was read by Professor Beckwith Whitehouse at the Coombe Hospital Centenary Meeting in Dublin in September. He showed that in these cases of disabling dysmenorrhœa there was always an escape from the uterus of fragments of membrane; that the condition was one of membranous dysmenorrhœa in a minor degree. If nothing is done the uterine muscle in the course of time undergoes hypertrophy and we get one form of the so-called chronic metritis.

(ii) Profuse bleeding may be due to an overgrowth of the endometrium, either in the diffuse variety or in the pedunculated form known as mucous polypus. It is recognized that curettage is the proper treatment.

(iii) The use of the curette in cases of profuse leucorrhœa will seem to many indefensible. What I may call the popular view of leucorrhœa is that the discharge comes from the vagina or from the cervix and never from the uterine cavity. Cases of vaginitis do not concern us here. Cervical catarrh or erosion may exist apart from a discharge from the uterine cavity, but in my opinion these two are generally associated. Further, I believe that in many cases the uterine discharge, owing to some irritative property, causes cervical erosion. I am confirmed in this belief by one type of case. Sir William Sinclair has called attention to a condition which he regarded as pathognomonic of retroversion, namely the erosion of the posterior lip of the cervix. There is no doubt that such a condition is found in many cases

of retroversion, though not in all. The explanation seems to me simple. If the uterus is in a position of extreme retroversion, the discharge is bound to flow over the posterior lip. Does it not therefore seem logical to try to get rid of the superficial glandular elements in the cavity of the uterus which secrete this irritative discharge? In old cases of cervical catarrh, with eversion of the lips and thickened tissues, an amputation of the cervix or the removal of a wedge from one or both lips may also be necessary.

I am ready to admit that the operation of curettage may be abused. Like many other operations it is liable to be performed not only indiscriminately and without well-defined indications, but in a perfunctory manner; yet in its proper sphere the results have been in my experience most satisfactory.

It seems to me that the opponents of curettage do either too little or too much. Some seem to regard the symptoms I have grouped as those of disordered uterine function of little consequence, especially if they arise in young, unmarried women. Pain and leucorrhœa in these cases are to them merely indications of hysteria or of general ill-health, and they trace them to defects in upbringing, or unsuitable diet, or bad hygiene, or to vicious habits. We regard them as a result of local causes which call for local treatment. On the other hand we have those who object to curettage in cases of dysmenorrhœa, but who incise the cervical canal. There are others who refuse to curette in cases of leucorrhœa, but who remove part or the whole of the cervix, or fix or suspend the uterus if it is retroverted.

(3) Operations for Suspension and Fixation of a Retroverted Uterus.

These operations are comparatively rare in our practice. It will be readily understood that cases suitable for suspension or fixation are limited in number if curettage is employed where the symptoms are those of disturbed uterine function and if vaginal operations are performed for various degrees of uterine prolapse, of which a retroversion is often merely an early stage. It it were proved that retroversion is a cause of uterine congestion, it would be the logical sequence to suspend the uterus. In the majority of cases the patient seeks advice mainly because she suffers from excessive or irregular bleeding or from leucorrhœa. In a small proportion there is distinct pelvic discomfort or pain, which is relieved when the uterus is pushed up. It is only in these latter cases that we suspend or fix, and not always in these. When the retroversion causes pain or discomfort there is always some enlargement of the uterus. A symmetrical enlargement is always due to subinvolution or to a pure hypertrophy. In either of these conditions some diminution in size may follow curettage, but the result is sometimes disappointing. It is then that suspension or fixation is of use, but if the case is one in which profuse hæmorrhage is a prominent feature, hysterectomy is justifiable.

(4) The Removal of the Ovaries when Hysterectomy is performed.

Most teachers lay stress on the importance of leaving the ovaries, provided that they are healthy, when the uterus is removed. The practice in Manchester is to remove them with the uterus and only to leave one or both if the patient insists on our doing so. The internal secretion of the ovary undoubtedly plays an important part in the metabolism of the body, and when the ovaries atrophy many disagreeable symptoms may follow. It seems reasonable to suppose that these will also be troublesome when the ovaries are removed by operation. There is no doubt that this is so when the uterus is left, but when both uterus and ovaries are removed these further effects are as a rule negligible. This we have found by experience, and our practice is entirely empirical. For years the radical operation has been performed in Manchester. I will refer you to a statistical inquiry published by Dr. Bride in the spring number, 1921, of the *Journal of Obstetrics and Gynæcology of the British*

Empire, confirming the conclusions which we had reached by experience. The radical procedure has further advantages: the operation is quicker, the final result is better, as the bleeding is more easily controlled, and a smooth pelvic floor is left with linear scar. Still more important, it does away with the risk of secondary changes in the ovaries, such as adhesions, cystic change and degeneration, which may render a second operation necessary.

I must conclude by saying that I am aware that I have raised many points that are open to discussion and that further research is required before we can arrive at anything like unanimity.

The Outcome of 214 Radical Abdominal Operations for Carcinoma of the Cervix Performed Five or More Years Ago.

By Victor Bonney, M.S., M.D., F.R.C.S.

Between April, 1907 and October, 1921, I performed Wertheim's operation for carcinoma of the cervix 214 times, and, from the beginning, I have, by means of letters or interviews, kept in touch with the large majority of the patients who survived the operations. This "follow-up" system, which has been a matter of considerable labour, extending over nineteen years, enables me now to review the outcome of these operations in a very accurate and thorough manner.

The Operation.

The operation I perform is, and always has been, as drastic and radical as I believe it is possible to perform, and yet give the patient a good chance of recovery. From the first, I have in every case removed the glands and cellular tissue occupying the obturator fossæ, as well as the glands lying along the iliac veins. As regards the vagina, I have gradually extended the operation, so that now I remove all, or practically all, of that canal. For the rest I have broadly followed the technique of Wertheim, but with certain modifications, which I believe to be improvements.

The earlier operations of this series were performed with the patient under simple ether anæsthesia, but in most of them, spinal anæsthesia with full ether anæsthesia has been employed. Those desiring them will find fuller details of the technique I employ in my previous publications on the same subject.

The Character of the Cases.

I have operated upon every case of carcinoma of the cervix presented to me, in which I thought there was any chance whatever of completing the operation, and a large number of the patients with whom this paper deals had been dismissed as inoperable from first-class hospitals. The only bars to the accomplishment of the operation that I have recognized have been deep and extensive involvement of the bladder or bowel, or of both ureters, to the extent of producing bilateral hydro-ureter. I early found that in many cases it is impossible by ordinary examination to decide whether a growth is removable or not, and in all cases of doubt, therefore, I have opened the abdomen and made an inspection. The policy I have consistently followed has no doubt led me to undertake many cases that it might have been prudent to let alone, as needlessly increasing the operation mortality-rate, and the recurrence-rate, but on the other hand, it has enabled me to pluck out from the fire, so to speak, some patients who otherwise would have perished. Certain of these patients are alive and well to-day, fifteen years or more after the operation. All the cases in which, during the period mentioned, I have been able to remove the uterus and any part of the vagina with it, have been included in this series. As regards classification of the cases, there is only one grouping which is reliable, because it does

not rest on personal opinion, or bias, namely, that which groups the cases according to whether the regional lymphatic glands are or are not carcinomatous at the time of the operation. I have adopted this in the past, and shall adopt it in this paper, for whilst there is no constant relationship between the difficulty of the operation and the presence or absence of glandular involvement (since a small, easily removable, primary growth may be accompanied by extensive carcinomatosis of the regional glands and vice versa), yet, on the whole, the cases with glandular involvement are the later and more difficult ones, and those without glandular involvement are the earlier and easier ones, and that is about the nearest one can get to the facts.

Of the 214 cases which comprise the series with which this paper is concerned, the regional glands were carcinomatous in 93, and not carcinomatous in 121. This percentage (44 per cent.) is exceptionally high, for Leitch and McCormack, studying post mortem a large number of cases in which women had died from the disease without operation, found that the glands were carcinomatous in only 35 per cent. My figures are, however, correct for my series, so that the unusually high percentage of glandular involvement may be due to fortuitous chance operating in a relatively small number of cases. Allowing for this, however, it shows that my standard of operability has been a very wide one.

Till the end of 1910, my colleague, Comyns Berkeley, and myself were able accurately to compute our operability-rate from the total number of cases of carcinoma of the cervix presenting themselves at Middlesex Hospital and Chelsea Hospital for Women, and it worked out at 63 per cent. After 1910 we were unable to do this, because the Middlesex Hospital acquired a large quantity of radium, with the result that the number of cases sent there in the last phases of the disease so increased that an estimation of our operative practice, which would be fairly comparable with that founded on the average class of case attending other hospitals, became impossible. Further, at the Chelsea Hospital for Women, my promotion from the out-patient to the in-patient department, and the more general taking-up of the operation by other members of the staff, prevented our getting reliable figures from that source. Therefore, in all our publications subsequent to that date we assumed our operability-rate at 63 per cent., as I shall do in this paper, although, in fact, it is now certainly higher, since increased experience has allowed me to attempt and carry through more difficult operations than formerly.

The Outcome of the Operation on the Basis of Five Years' Freedom from Recurrence.

Five years' freedom from recurrence used to be considered as indicative of a "cure," and all the earlier statistics relating to the operation were therefore founded on this basis. Time has shown, unfortunately, that this period is too short, and that a certain number of recurrences take place after its expiry. I shall, however, begin by presenting my figures on this basis, which are as follows:—

Died from operation	34
Died from recurrence	82
Died from other disease	5
Lost sight of	8
Free from recurrence after five years ...	85
	214

Operative deaths.—The operative mortality for the whole series is 15·8 per cent. There were twenty operative deaths in the first 100 cases (20 per cent.), and fourteen operative deaths in the remaining 114 cases (12 per cent.). This latter figure is somewhere about the same as my operative mortality at the present day, and I do not expect to reduce it much lower, so long as I continue to undertake the same large

number of "last chance" operations that I have undertaken in the past. A general operative mortality is, however, chiefly of academic interest, for each case is a law to itself in this regard, and the surgeon can, if he chooses to keep clear of advanced growths in debilitated, worn-out women, present his achievements in a much more favourable light. I myself have not followed this policy, for though it may be argued that it is injudicious to discredit a valuable procedure by applying it to cases in which it is unlikely to succeed, yet on the other hand, I hold it right that someone should be prepared to give patients, suffering from this horrible disease in an advanced form, a chance of relief when they ask for it.

Recurrence.—Sixty-two per cent. of the recurrences occurred and killed the patients in under two years from the operation, 17 per cent. between two and three years, 11 per cent. between three and four years, and 10 per cent. between four and five years. Early recurrence usually takes place in the pelvic cellular tissue, the rectum or the bladder, or the upper end of the vagina, if this has not been entirely removed. The later recurrences are mostly situated in the tissue along the side wall of the pelvis and covering the great vessels, or in the pelvic bones or vertebræ. The large proportion of early recurrences is due to the fact that the series includes so large a proportion of very advanced cases, in some of which, though the operation affected the removal of the uterus and part or all of the vagina, yet it was obvious at the time that the chances of long respite from the growth were small.

Died from Other Disease.—Five so died. Seeing that the average age of the 180 patients who survived the operation was somewhere about 50 years, five deaths from intercurrent disease are no more than one would expect, judging from standard insurance statistics.

Cases Lost Sight of.—That there are only eight of these indicates the closeness with which I followed up all the patients for five years after their operations. Four were lost sight of under two years from the operation, three between two and three years, and one between three and four years. They were all free from recurrence when last heard of. To follow up successfully, it is necessary to obtain not merely the address of the patient but also the names and addresses of two or three of her friends and relatives, to whom one can apply if letters to the patient herself are returned marked "gone away, address unknown."

Free from Recurrence After Five Years.—There are eighty-five of these. The accomplishment-rate of the operation depends upon the point of view from which it is considered. Thus, taking my operability-rate as 63 per cent., then the 214 cases of this series represent those chosen for operation out of 340 unselected patients presenting themselves for treatment, and out of these 340 patients I have by operation achieved eighty-five "five-year cures," or 25 per cent. This is an underestimate, for my operability-rate is certainly higher than the figure assumed (*vide supra*).

If, on the other hand, the number of patients operated upon is alone considered then I have obtained a "five-year cure" in eighty-five out of 214 operated on, or just under 40 per cent. Lastly, if one considers only those patients who survived the operation, then I have obtained a "five-year cure" in eighty-five of the 180 so surviving, or 47 per cent. These figures may be modified to the improvement of the operative outcome by subtracting the thirteen cases that either died of other disease or were lost sight of, but this complicates figures which, as far as their practical use is concerned, must not be pushed to the meticulous decimal point, but taken broadly as expressing a general expectation. Thus, an operator employing the same technique as I do, and operating on the same types of patient, may expect that his proportion of recurrences to "five-year cures" will be as the ratio of forty-nine to fifty-one.

Influence of Glandular Involvement.—Still dealing with the cases on a five-year

basis, we now pass on to consider the effect of glandular involvement on the operative outcome. The figures are as follows:

	Glands carcinomatous	Glands not carcinomatous
Died from operation	20	14
Died from recurrence	45	37
Died from other disease	2	3
Lost sight of	3	5
Free from recurrence after five years	23	62
	93	121

The operative death-rate is seen to be much higher in the cases in which the glands were carcinomatous, 21 per cent. against 12 per cent. This is because as a class the growths were more advanced, and the operation more difficult. The recurrences also are relatively much more numerous, 61 per cent. of those surviving the operation as against 34 per cent. They also occurred somewhat sooner, 66 per cent. of them as against 59 per cent. killing the patients in under two years. The ill-effects of glandular involvement are, however, most obvious when one considers the numbers of "five-year cures" in the two columns which, when contrasted in their relation to the number of patients surviving the operation, stand in the percentage proportion of thirty-one to fifty-nine.

It is nevertheless encouraging, as it is surprising, to find such an unexpected number of "gland-involved" cases in which as the result of the operation the patients obtained five years' freedom from recurrence.

THE OUTCOME ON THE BASIS OF SEVEN YEARS' FREEDOM FROM RECURRENCE.

A certain number of recurrences take place after five years. It was some time before this unpleasant fact became apparent, so that all the older statistics, including those previously published by me, are founded on the five-year basis. An extension of the length of time necessary to elapse before "absolute cure" can be claimed naturally suggests itself, and though, as I shall show, even seven years is insufficient, yet, since it covers the vast proportion of recurrences, I will now proceed to give my figures on this basis.

Of the 214 operations whose outcome is recorded in the preceding tables, 182 were performed between April, 1907, and October, 1919, and are therefore available for examination on the seven-year basis. Unfortunately my figures on this basis are not so complete as those I have just tabulated on the five-year basis, because in the earlier years, before the necessity for a "follow-up" longer than five years was apparent to me, I ceased to keep in touch with the recovered patients after five years, and when, later on, I endeavoured to regain touch with them, I was in many cases unsuccessful, as they had moved away, and their new addresses were unknown. My difficulties were the greater because when I first began to follow up I did not appreciate the necessity of getting the names and addresses of several relations or friends in addition to those of the patient herself. However, for the purposes of this paper, I have made a special effort, with the result that of the 150 patients to be considered on the seven-year basis who recovered from their operation I am able to record the fate of all but twenty. The figures are as follows:—

Died from operation	32
Died from recurrence	69
Died from other disease	5
Lost sight of	20
Free from recurrence after seven years ...	56
Total ...	182

Operative Deaths.—This is much the same as that recorded in the five-year tables. I had 20 operative deaths in the first 100 cases, and 12 in the succeeding 82.

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Recurrences.—Of the 150 patients who survived the operation, 69, or 46 per cent., certainly died of recurrence within seven years. Of these deaths by recurrence, 42 took place under two years, 11 between two and three years, 7 between three and four years, 4 between four and five years, and 5 between six and seven years after the operation. The fact that 5 recurrences took place between the sixth and seventh years is very disappointing, and shows how essential it is that in the future the " follow-up " of these cases should be carried on for a much longer time than has heretofore been done.

Cases Lost Sight of.—I have already explained the reason why there are so many of these. Eight of them were lost sight of before the end of the fifth year as recorded in the five-year basis tables. Ten of them were lost sight of after the fifth year, and two after the sixth year. All these twelve patients are included as " cures " in the five-year basis tables; some of them may have had recurrence since they were lost sight of, but I judge not many, if any, my experience being that if this occurs, either the patient herself or her doctor gets in touch with me again. All of them were quite well when last heard of.

Free from Recurrence after Seven Years.—There are 56 of these. Computing the accomplishment rate in the various ways already detailed under the five-year basis tables, the following figures are obtained. Taking my operability-rate as 63 per cent., the 182 cases operated upon represent those chosen for operation out of 300 unselected patients originally applying for treatment, and out of these latter the operation effected 56 seven-year cures, or over 18 per cent. Considering only the patients operated upon then, a " seven-year cure " was effected in 56 out of the 182, i.e., 30 per cent., or taking only the 150 patients that survived the operation, over 37 per cent. These figures do not do the good results of the operation full justice on account of the large number of cases lost sight of.

The Effect of Glandular Involvement.—Examining the question of glandular involvement as it has affected the 182 cases investigated on the seven-year basis, the following are the figures:—

	Glands carcinomatous	Glands not carcinomatous
Died from operation	18 ...	14
Died from recurrence	35 ...	34
Died from other disease	2 ...	3
Lost sight of	4 ...	16
Free from recurrence after seven years	17 ...	39
	76 ...	106

The death-rates are practically the same as those recorded in the previous tables, and as in those, recurrences are much more numerous in the cases in which the glands were involved, especially when considered in relation to the number of patients surviving the operation, the percentage ratio being as 60 to 37. As regards rapidity of reappearance, there were a larger number of early recurrences, both actually and relatively, in the gland-involved group, but it is curious to note that of the five cases of recurrence after five years, four took place in patients whose regional glands were not carcinomatous at the time of their operations.

The number of seven-year cures in the group in which the glands were carcinomatous is only 29 per cent. of the patients recovering from the operation, as against 41 per cent. in the case of the group in which the glands were not involved, and the difference would be greater still, if it was not that the latter group contains so many " lost-sight-of " cases. On the other hand, the fact that out of 76 cases, all advanced to the stage of gland involvement, the operation effected no less than 17 seven-year cures is remarkable.

THE OUTCOME ON THE BASIS OF TEN YEARS' FREEDOM FROM RECURRENCE.

Out of the whole 214 cases, three deaths due to recurrence occurred after seven years, two in the eighth year and one in the tenth year. This deplorable fact shows that seven years' freedom from recurrence is not a period long enough on which to found with certainty the claim of absolute cure, though it comes very near to it. I shall therefore proceed to review on a ten-year basis the 130 operations I performed between April, 1907, and October, 1916.

The figures for this series are as follows:—

Died from operation	25
Died from recurrence	45
Died from other disease	4
Lost sight of	20
Free from recurrence after ten years ...	36
	130

Operative Deaths.—The operative mortality is 19 per cent., which is considerably higher than that of the 214 operations reviewed on the five-year basis, and higher than that of the 182 operations reviewed on the seven-year basis, because of the larger proportion of my earlier operations that the series contains.

Recurrences.—Of the 105 patients who survived the operation, 45, or 43 per cent., are known to have died from recurrence within ten years. Of these deaths, 26 took place under two years, 7 between two and three years, 5 between three and four years, 2 between four and five years, 2 between six and seven years, 2 between seven and eight years, and 1 between nine and ten years.

Cases Lost Sight of.—There were 20 of these. Six of them were lost sight of before the fifth year, 10 of them between five and six years, 2 of them between six and seven years, 1 between seven and eight years, and 1 between nine and ten years from the date of their respective operations.

Free from Recurrence after Ten Years.—There are 36 of these. Computing the accomplishment rate in the manner employed when estimating the "five-year basis" results, the following are obtained. Taking my operability-rate as 63 per cent., the 130 cases operated on represent those chosen for operation out of 206 unselected patients originally applying for treatment, and out of these latter the operation effected 36 "ten-year cures," or over 12 per cent. Considering only the patients operated on then, a "ten-year cure" was effected in 36 out of the 130, namely over 27 per cent., or taking only the 105 patients that survived the operation, over 34 per cent. It must however be pointed out that in this series, owing to the much larger proportion that the number of "lost-sight-of" cases bears to the total number of operations, this estimate of the accomplishment rate places it unfairly low. I shall in the next section endeavour to give an estimate more in accord with all the facts.

The Effect of Glandular Involvement.—The figures illustrating the effect of glandular involvement are as follows:—

	Glands carcinomatous	Glands not carcinomatous
Died from operation	12 ...	13
Died from recurrence	21 ...	24
Died from other disease	2 ...	2
Lost sight of	4 ...	16
Free from recurrence after ten years	11 ...	25
	50 ...	80

Recurrences, as in the five-year basis and corresponding tables under the seven-year basis, are much more numerous in the group in which the glands were carcinomatous, the percentage ratio being as 42 to 31; but it is worth noting that the difference between the recurrence rate of the two groups is less marked than it

is between the similar groups of the seven-year basis series, and still less than between those of the five-year basis series, which seems to suggest that recurrence, when fated to occur, does so after a longer interval of time in the patients in whom the regional glands are not carcinomatous at the time of the operation, and this is borne out by the actual figures. The number of ten-year cures is nearly 29 per cent. of the patients recovering from the operation when the glands were carcinomatous, against 37 per cent. when the glands were not carcinomatous, but the comparison is unsound because of the large number of "lost-sight-of" patients in the group in which the glands were not involved.

A Review of the Fates of all the Patients as known up to the Present Time.

Finally, in the following table are presented the fates of all the 214 patients with whom this paper is concerned, so far as they are known to me at the present time. The patients are arranged in groups according to the length of time over which it has been possible to keep in touch with them. The length of the "follow-up" period in the case of any individual patient depends upon whether she (1) dies from recurrence; (2) dies from other disease; (3) is lost sight of; or (4) is under observation up to the present time. In the table, therefore, the patients comprising each group are subdivided under these four heads, which not only show why the "follow-up" was limited to such and such a time, but also the condition of the patients at the expiry of that time.

A perusal of this table will show that it amplifies much of the information already given, besides bringing out several new points. Thus, it shows that the number of patients free from recurrence for periods varying from five to eighteen and a half years, and still being kept in touch with is 57, and of these no less than 32 have survived their operation over ten years, whilst 4 have been lost sight of or died from other disease after that length of time. It will also be seen that the total number of known deaths from recurrence is 90, or exactly one-half of the 180 patients who recovered from their operations.

If it had been possible to keep in touch with the remaining 90 up to the present time, there would have been no difficulty in giving figures which would accurately express the final outcome of all the operations as far as the fate of the patients with regard to carcinoma of the cervix is concerned. Unfortunately the matter is complicated by the number of cases lost sight of from one reason or another, but it is possible to make an estimate sufficiently accurate for the purposes of prognosis by reckoning the chances of recurrence of the individual patients with whom one is no longer in touch.

Thus, of the 130 operations performed ten or more years ago, 24 of the patients have been lost touch with, 10 of them before five years, and 14 of them after five years from their operations. The chances that recurrence has taken place, or would have taken place, is very different in these two groups, for only 10 per cent. of the total known recurrences take place after five years (4 out of the 45 in the ten-year basis table and 8 out of the whole 90 known recurrences).

If, therefore, we assume that of the ten patients lost touch with before five years, seven have or would have died of recurrence, and of the fourteen lost touch with after five years, two have or would have died of recurrence, we shall not be unduly favouring the operation, but rather the reverse, as is desirable. This would bring the number of deaths by recurrence up to fifty-four, and the number of "ten-year cures" (absolute cures) up to fifty-one. This means that if it were possible for a surgeon to perform such a series of these operations on one day, instead of spreading them out over a number of years, and keep in touch with all the survivors, nor lose any of

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Duration of "follow-up"	Condition at end of that time	Number of patients	
Nil	Died from operation	34	
Under two years	Died from recurrence	51	= 58
	Died from other disease	3	
	Well and then lost sight of	4	
Between two and three years	Died from recurrence	14	= 18
	Died from other disease	1	
	Well and then lost sight of	3	
Between three and four years	Died from recurrence	9	= 11
	Died from other disease	1	
	Well and then lost sight of	1	
Between four and five years	Died from recurrence	8	= 8
	Died from other disease	0	
	Well and then lost sight of	0	
Between five and six years	Died from recurrence	0	= 14
	Died from other disease	0	
	Well and then lost sight of	9	
	Well and still in touch with	5	
Between six and seven years	Died from recurrence	5	= 15
	Died from other disease	1	
	Well and then lost sight of	3	
	Well and still in touch with	6	
Between seven and eight years	Died from recurrence	2	= 10
	Died from other disease	0	
	Well and then lost sight of	1	
	Well and still in touch with	7	
Between eight and nine years	Died from recurrence	0	= 4
	Died from other disease	0	
	Well and then lost sight of	1	
	Well and still in touch with	3	
Between nine and ten years	Died from recurrence	1	= 6
	Died from other disease	0	
	Well and then lost sight of	1	
	Well and still in touch with	4	
Between ten and eleven years	Died from recurrence	0	= 10
	Died from other disease	2	
	Well and then lost sight of	1	
	Well and still in touch with	7	
Between eleven and twelve years	Died from recurrence	0	= 5
	Died from other disease	0	
	Well and then lost sight of	0	
	Well and still in touch with	5	
Between twelve and thirteen years	Died from recurrence	0	= 5
	Died from other disease	1	
	Well and then lost sight of	0	
	Well and still in touch with	4	
Between thirteen and fourteen years	Died from recurrence	0	= 4
	Died from other disease	0	
	Well and then lost sight of	0	
	Well and still in touch with	4	
Between fourteen and sixteen years	Died from recurrence	0	= 9
	Died from other disease	0	
	Well and then lost sight of	0	
	Well and still in touch with	9	
Between sixteen and nineteen years	Died from recurrence	0	= 3
	Died from other disease	0	
	Well and then lost sight of	0	
	Well and still in touch with	3	
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them by other disease, he would find at the end of ten years that slightly more than one half of those who had survived the operation had died of recurrence, whilst slightly less than half could be claimed as absolute cures.

This estimate I believe to be correct for all practical purposes, but its application is an entirely general one. To what extent can we apply it more particularly?

As regards the chances of recurrence and cure in cases in which the glands are found carcinomatous at the time of the operation, a similar process of reckoning shows that, roughly, they stand in the relation of 2 to 1, whilst, when the glands are not carcinomatous, they are as 2 to 3. As I have pointed out, these two groups are not clinical groups, because the presence or absence of involved glands cannot be ascertained before the operation, but, nevertheless, they do accord with a rough grouping into the more advanced and difficult cases on the one hand, and the earlier, easier cases on the other.

If we assume an operative death-rate of 20 per cent. for a group in which most of the cases are well advanced, and some greatly advanced, and an operative death-rate of 10 per cent. for a group in which, though some of the cases are well advanced, most of them are fairly early, the following suppositious results are probably somewhere near the truth.

	Well advanced group	Moderately early group
Operative deaths	20	10
Number of recurrences	54	36
Number of absolute (ten year) cures	26	54
	100	100

These two groups are not homogeneous. The first contains some greatly advanced cases on the one hand and some moderately advanced cases on the other, besides the central bulk of well advanced cases, whilst the second contains some moderately advanced cases on the one hand, and some very early cases on the other, besides the central bulk of moderately early cases. One may hazard an estimate of the operative outcome in these five classes of case as follows:—

	Greatly advanced	Well advanced	Moderately advanced	Moderately early	Quite early
Operative deaths	25	20	15	10	5
Number of recurrences	57	54	43	36	15
Number of absolute (ten year) cures	18	26	42	54	80
	100	100	100	100	100

These estimates presuppose that the operation performed is as fully radical as I have described at the beginning of this paper.

Can we clinically distinguish these five classes of case for purposes of prognosis? The answer is that we cannot with certainty. This particularly applies to growths in elderly women, which may appear quite early to vaginal touch, when in reality they have passed beyond the confines of the cervix into the para-cervical tissue. Nevertheless it may be necessary to try to make an estimate of the chances afforded by the operation in particular cases, for the patient's friends, and sometimes the patient herself, will ask the question. In forming an opinion, every point that bears on the particular operation has to be taken into account. The patient's age, her physique and state of health, the duration of pain if present, the duration of bladder symptoms if present, the degree of mobility of the cervix, whether the vaginal wall is involved or not, and if involved, the situation of the involvement, and finally the duration of the bleeding. There is not one of these points which may not be fallacious, but the most reliable as guides to the operative outcome are the presence or absence of pain and bladder symptoms, and the duration of the bleeding. The duration of the bleeding, including under that term blood-stained discharge, is

perhaps the least fallacious of all, and in this regard, the following rule is a very useful one:—Three month's bleeding, growth certainly removable; six months' bleeding, probably removable; nine months' bleeding, possibly removable; twelve months' bleeding, irremovable. The five classes of case I have just cited would correspond roughly to histories of bleeding for one month, three months, six months and twelve months respectively.

Discussion.—Dr. CUTHBERT LOCKYER said that Mr. Bonney, together with his colleague, Mr. Comyns Berkeley, had devoted many years to the perfecting of this operation, first instituted by Wertheim. The result was that a more extensive and thorough operation was now performed by the Middlesex operators than that practised by Wertheim himself. It was doubtful whether such advanced technique could be attained by every individual surgeon, especially when it was remembered that those who operated in small provincial hospitals had few chances of acquiring such skill. If the statistics of every Wertheim operation performed in this country since 1905 could be collected the figures would not show such good results as those obtained by Mr. Bonney. Mr. Bonney's operation mortality was 16 per cent., his five-year cures amounted to 25 per cent. This was something definite to go upon and now we wanted to compare this result with that obtained by other methods.

Statistics as to the use of radium on a five-year basis were not numerous but those already obtainable seemed to compare favourably with operative results. Gray, Ward and Schmitz had treated by radium, or by radium and X-ray, thirty-five cases of operable cancer of the cervix with the result that 60 per cent. were alive and free from recurrence after five years, whilst of fifty-five advanced cases, traced for five years, eight were free from recurrence, i.e., 14·5 per cent. cured. Again, Heyman, of Stockholm, reported that of thirty-six operable cases treated by radium fourteen were free from recurrence after five years, i.e., 40·5 per cent. of "cures." Heyman also stated that of 234 inoperable cases thirty-nine were free from recurrence after five years, i.e., 16·7 per cent. cured. These curative results by radium treatment needed further confirmation, but as there was no primary mortality to be deducted from them, they (so far as they went) compared very favourably with Mr. Bonney's 25 per cent. of cures in those which survived the operation.

From 1905 up to December, 1925, he (Dr. Lockyer) had performed the extended operation in 112 cases of cancer of the cervix and he was much impressed by recurrences occurring as late as twelve and fifteen years after operation. The sum of his experience had led him to believe that in advanced cases (when the cancer had trespassed beyond the cervix) it was better to employ radiotherapy and not to attempt the extended operation. He was firmly convinced of the value of the operation for cases in which the cancer was confined to the cervix, and he strongly believed in the employment of radium before operation.

Professor FLETCHER SHAW (Manchester) said that all gynæcologists who had done a considerable number of these operations should publish their figures so as to render possible a general estimate of the value of the operation. He himself had operated upon seventy-six cases more than five years ago with the following results:—

Death from operation	16	... ...	21 per cent.
Recurrences	25	... ...	33 ,,
Deaths, other causes	2	... ...	2·4 ,,
Not traced	3	... ...	3·6 ,,
Alive and well at end of five years	30	... ...	40 ,,

These results showed that of all the patients who underwent this operation 40 per cent. were alive and well after five years, a result which could not yet be obtained by any other method of treatment. During the last six years a large number of his cases had been treated with radium before the operation and he had found that there was a considerable difference in the result as between these patients and those operated upon without previous application of radium. Of those treated by radium before the operation 41 per cent. were alive and well, while of those upon whom the operation alone was performed without radium only 32 per cent. were still living.

Mr. L. C. RIVETT said that he had first performed Wertheim's operation in 1919, and for the fortieth time that afternoon at the Chelsea Hospital for Women. He was unable, therefore, to give statistics on even a five-year basis. In ten of his cases the patients had died from the operation—a mortality of just over 25 per cent. He was surprised to hear that

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Mr. Bonney had lost so few cases from intercurrent disease, as his (Mr. Rivett's) experience coincided with that of Professor Fletcher Shaw, namely, that renal affections were a most serious complication. He (Mr. Rivett) had lost three of his own cases from chronic renal trouble a few months after the patients had left hospital apparently well, and in at least two of his operation-mortality cases the patients had succumbed to this complication.

Dr. H. RUSSELL ANDREWS said that his own figures were not so good as those of Mr. Bonney. Some years ago he (Dr. Andrews) had followed up all the survivors of his first 100 Wertheim hysterectomies and had been able to prove that only twenty-four patients were alive and well from five years upwards. He could not take much interest in "operability-rate," as there were many obvious fallacies in comparing the "operability-rate" of one surgeon with that of another. He knew that Mr. Bonney performed a more thorough operation than most operators, including himself (Dr. Andrews), and he thought that there was no doubt that he operated in some cases which most operators would consider too far advanced for operation. This made his mortality-rate high, but also gave him a chance of more "total cures." He (Dr. Andrews) had been struck by the fact that in some cases, in which at the end of the operation he had felt that he had possibly operated against his better judgment and that the operation had hardly been worth while, the patients remained free from recurrence for a surprisingly long time. Most of his patients who were alive and well five years or more after the operation were elderly, over sixty or in the late fifties. He found it hopeless to attempt a prognosis in any given case; in some early cases recurrence took place soon, while in one of his youngest patients, aged 29, at the time of operation, with an advanced carcinoma, removal of which had entailed making a large hole in the bladder, the patient was alive and well when last heard of—over five years after the operation. Personally, he did not consider that a long history of bleeding was the most adverse symptom, but agreed with Professor Fletcher Shaw that presence of pain was more important.

Section of Orthopædics.

President—Dr. W. T. Gordon Pugh.

Orthopædics at a Country Children's Hospital.

PRESIDENT'S ADDRESS.

By W. T. Gordon Pugh, M.D.

In an opening address a President has free choice of subject and, so far as my observation goes, has usually selected one which has attracted him through his career. I have followed this example.

Some thirty years ago when filling several resident appointments at a general and a children's hospital in London, I was greatly impressed with the need for country institutions in which children suffering from crippling diseases, such as rheumatic carditis, poliomyelitis and tuberculosis, might receive adequate medical and surgical treatment and expert nursing for as long a period as was really necessary. Twelve years later, in 1909, it was my good fortune to be called upon by the Metropolitan Asylums Board to open and organize a country children's hospital of 900 beds, which had cost nearly a third of a million in construction and equipment.

Designed as a convalescent hospital for fever patients but never used as such, it was situated at Carshalton on the Surrey Downs in a park of 136 acres. The patients' blocks were ideal for the purpose, being single-storied with courtyards open only to the south. As a children's hospital, however, it required, not only a considerable increase in the staff accommodation, but also certain additions, such as an operation theatre, a gymnasium, a workshop for surgical appliances, and a chapel. All these were provided by the conversion of ward blocks, and the resulting loss in patients' accommodation was made up by erecting verandahs around the courtyards, in which 300 children might live day and night, winter and summer, continuously in the open-air. For the entertainment and instruction of the patients a recreation hall and school-rooms were built, and in course of time a seaside branch, with lawns extending to the beach, was established near Littlehampton, and still later a light department was arranged for use, especially in the colder months.

From the beginning the hospital has admitted all classes of children's diseases, but year by year the orthopædic work has increased, and now, out of every 100 patients, about 40 are orthopædic, 30 have non-pulmonary tuberculosis, and 30 are suffering from other diseases. Originally all were admitted by the agency of boards of guardians, but since the Tuberculosis Scheme became operative in 1914, patients with surgical tuberculosis have been admitted chiefly on the authority of the London County Council. All the paralytic and other orthopædic cases, however, continued to be admitted through the Guardians until 1924, when 50 beds were allocated to cases of poliomyelitis to be admitted through the Council.

The Council's poliomyelitis beds are intended especially for patients in the second stage, which begins with the disappearance of tenderness and lasts until the condition has become stationary, perhaps as long as two years. It is during this stage that stretching and fatigue of the muscles have to be avoided, and deformity, which often sets in rapidly, prevented; not only is splintage, both recumbent and ambulatory, required, but heat and massage are beneficial, with electricity in some cases and muscle-training in all. I think that in the majority of cases of any severity in-patient treatment is preferable to attendance at an out-patient department

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during the first year; the number of such cases occurring in London is not so great as to render this impossible, having regard to the number of institutions for crippled children which exist around London. This is the time when most good can be done, and not infrequently the improvement is striking. Even under the best circumstances, however, the effects of the disease on the child's prospects in life are often appallingly serious; and Mr. Elmslie has shown that it is now the commonest single cause of crippling among the school-children of London. Each year 100 new pupils, on an average, join the schools for physically defective children crippled by poliomyelitis.

The block reserved for these cases at Carshalton has its own gymnasium, and is equipped with Murray Levick red-ray lamps. Its staff includes two gymnasts who each morning apply massage and faradic electricity, and re-educate the patient in the use of his limbs. The afternoons are spent in games arranged specially by the massage superintendent.

I shall not have time to speak of the patients admitted in the later stages of poliomyelitis for operative correction or stabilization, or for the provision of appliances, nor of those suffering from other deformities. The methods of treatment do not differ materially from those adopted at other hospitals. I shall pass on to a very brief consideration of surgical tuberculosis, confining my remarks to the most important form—that affecting the spine and the hip.

Before the war these cases were admitted in considerable numbers, on an average 140 a year; yet not 10 per cent. were received within twelve months of the onset of the disease. One hoped that as time went on, and the facilities for treatment provided by the public authorities became better known, more and more patients would be sent to the country at an early stage of the disease. With the spread of the interest in orthopædics which has followed the war, there has been a notable improvement in this respect. Gradually, too, the relatively short but annoying delay which resulted from the intervention of different authorities has been eliminated, and now the arrangements made for admission are almost beyond criticism. (Since the beginning of this year it has been open to any almoner to telephone to the London County Council that the surgeon wished to transfer a case of hip or spine tuberculosis from the out-patient department to a country hospital, and an ambulance has been sent forthwith to remove it to Carshalton.)

I had thus an excellent opportunity of learning, not only by personal experience, but also from the results of treatment by many others; and I was impressed by several things. One was the serious consequence of too short a period of recumbency in spinal tuberculosis, and the mistaken faith of many medical men in the efficiency of the spinal jacket. It did not seem to be generally appreciated that, in the case of a child, no jacket can relieve the softened vertebral bodies of superincumbent weight. The result all too frequently was marked deformity, associated sometimes with psoas sinuses and amyloid disease. Many cases with septic sinuses and amyloid disease, hopeless from the day of admission, occupied beds for years before the inevitable termination. Another point which could not fail to attract attention was the occurrence of secondary deformities of other parts of the body—flat foot, due to contracture of the tendo Achillis, and genu recurvatum in both spine and hip cases; also scoliosis and genu valgum in hip cases. Shortening of the tendo Achillis does not occur if the ankles are put through a full range of movement each day. The genu recurvatum, which is really to a great extent a bend in the upper part of the tibia, can be entirely avoided if the knees are kept a little flexed. The scoliosis associated with a hip ankylosed in adduction is the result, partly, of not insisting throughout recumbency that the interspinous line is kept at right angles to the long axis of the trunk, and,

partly, of getting rid of flexion too thoroughly and so destroying the normal lordosis. Genu valgum, if at all marked, is most commonly the result of an unduly prolonged attempt to correct adduction by weight traction.

The appliances which had been used were many and varied. Spinal cases had been treated on spinal boards, Bradford and Whitman frames, double Thomas splints, Berck trays, plaster beds and Phelps's boxes. All these appliances had features which recommended them, all had imperfections. A drawback common to them all was that the straps and buckles which restrained the patient were within his reach, and for this reason the recumbency which should have been maintained was often by no means complete, and the supervision called for was a constant strain upon those responsible for the nursing. Some appliances required that the skin of the back should receive daily attention; in others crumbs from food and the like collected under the child. Secondary deformities were not prevented, and in some appliances there was no arrangement for the use of the bed-pan without disturbing the back. Portability

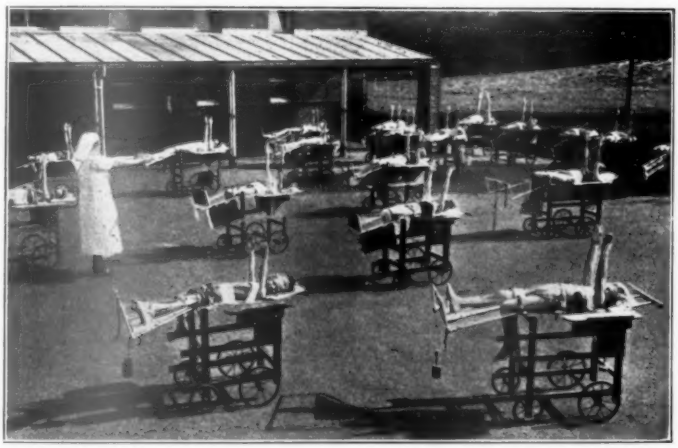

FIG. 1.—Gymnastic exercises for recumbent patients.

was limited, and even the most portable apparatus was not very convenient to move more than a short distance. Finally, in the use of some appliances parts of the body not affected by the disease were more or less fixed, an unnatural restriction which could not fail to be harmful to the child's general health.

When an appliance fails we are apt, I am afraid, to blame the nurse or the patient or both, but this is not always fair. It is for the surgeon to consider whether his splint is not partly responsible, and to endeavour to eliminate the causes of failure. Thus there were gradually evolved the frames and the carriage which I have used at Carshalton for a number of years. Apart from nursing conveniences and the fact that the back has to be attended to only once a month, they allow regular exercises to be given to the arms, legs and lungs, facilitate heliotherapy and light treatment and save the children from being confined within the boundaries of their wards (fig. 1).

In recent years ideas have changed as regards the treatment of deformity. One used to attempt to reduce the prominence by hyperextension at the seat of disease.

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In cases of some standing the effect was usually negligible, but in the more acute cases the hump was sometimes reduced considerably. Unfortunately the deformity not infrequently returned, partially or entirely, when the patient had been up a few weeks or months. The jacket, which was made to a cast of the patient, fitted perfectly at first, but soon began to press on and abrade the apex of the prominence. If the diseased centra are separated by hyperextension, the interval between them becomes filled by fibrous tissue, which in course of time may calcify. This is poor material—in the case of the lower dorsal region, for example—to bear the weight of the head, the upper trunk and the upper limbs, together with anything that is carried, including the clothes, except socks and shoes. For this reason, I have for several years avoided running the risk of creating a space between the diseased centra, and have

FIG. 2.—Adjustable celluloid and duralumin jacket for mid-dorsal caries.

endeavoured to neutralize the deformity by producing compensatory curves, placed above the deformity, if this is low; below, if it is high; both above and below, if it is in the mid-dorsal region.

The rationale is as follows: If there is collapse of the bodies in, for instance, the dorso-lumbar region, the upper part of the spine tends to bend forward, and the child lordoses its back to maintain the centre of gravity over its feet, thus accentuating the deformity. If a compensatory curve is established above the hump, the need for the lordosis is gone. Further, since the vertebræ above and below the infected area will continue to grow normally, in the course of time the prominence will form a limited deformity while the spine steadily elongates in a compensating direction. If the treatment is carried out on a narrow frame, the patient acquires a permanent habit of keeping the shoulders well back, and it is remarkable how completely camouflaged a moderate prominence becomes.

When the period of recumbency is over, a celluloid jacket is worn, capable of being enlarged as the patient grows (fig. 2, p. 4). It extends anteriorly well up in front of the shoulders, but behind only to the point at which the bend in the frame was made, so that the continued production of the compensating curve may be encouraged. Those jackets, so often seen, which enclose the shoulders and cover the hump, increase, not lessen, the deformity and should never be worn. Further, if they are not capable of enlargement in all directions, they compress the growing thorax and pelvis.

During the later part of the period of recumbency it is important to strengthen the back muscles, which naturally tend to waste during the frame treatment. The patient lies on an ordinary mattress in the prone position, and is given massage and exercises. After the jacket has been supplied, more elaborate exercises are given in the gymnasium, for, as Murk Jansen says, a well-developed erector spinæ is the best spinal splint.

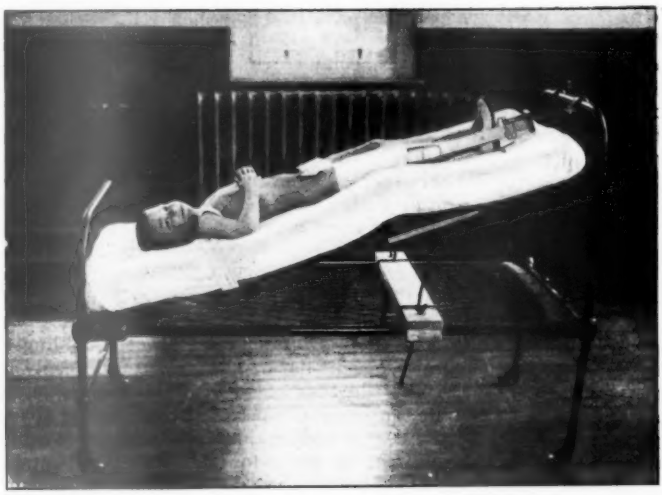

FIG. 3.—Traction by suspension. Slight flexion of the knee is secured by the insertion of a bar under the mattress, and external rotation is prevented by a sandal, to the sole of which a piece of wire, bent to the shape of an inverted T, is screwed.

I will now say a few words about hip disease. It is my firm opinion that if all cases of hip disease, both probable and definite, were sent forthwith to a country hospital, and really effective traction applied, the number of seriously damaged hip-joints would decrease very appreciably. I think there can be no doubt that in a large proportion of the cases the disease begins in the bone, and that limp and some limitation of movement are definitely present before it has extended to the joint-cavity proper. This is the time to apply intensive constitutional treatment—continuous life in the open-air, heliotherapy, good food, cod-liver oil—combined with effective traction. Owing to the insidious onset we must expect not to get spinal cases in the earliest stages, but a limp is a sign which cannot escape observation, and I understand that recently the school-teachers have been asked to report children who develop a limp, in order that they may be referred to a surgeon for

examination. I believe that it has only to be realized how urgent are cases of hip tuberculosis for the results of treatment to be immensely improved.

If, on admission, there is marked general thickening around the joint with pain and tenderness, and the patient appears to have little power of resisting the disease and to be definitely ill with it, or if septic sinuses are already present, it is hopeless to expect a usefully movable joint, and a Jones's abduction frame, or one of its modifications, is probably the most comfortable and generally convenient splint. If, on the other hand, the disease is comparatively recent and general thickening is absent, even though there may be localized abscess formation, and the patient shows an average amount of constitutional resistance, I think it is well to try the effect of traction by suspension. In its simplest form, the mattress, resting for its whole length on a fracture board, is raised at one end to the level of the top rail of the bedstead head, and the cord of a strapping extension, applied to the thigh of the affected limb, is tied to the rail (fig. 3). The weight extending the joint is thus the patient's body, and it is remarkable how in a single night an acutely tender and markedly malposed joint will painlessly fall into good position. Whichever of these two methods is indicated at first, the time will arrive when the joint may without detriment, have, in the one case less complete fixation, in the other less complete traction. It is then my practice to use a modified form of the spinal frame, with a weight extension, the whole being mounted on a carriage, which allows the patient to share in the social life of the hospital. Generally speaking, the results vary inversely with the number of months the disease has existed preceding the patient's transfer to the country. Each year a number of cases, with apparently active disease on admission—some even with abscesses and showing well-marked radiographic changes, but admitted within a few months of the onset—leave the hospital with complete return of function in the joint.

I cannot conclude without referring to after-care. Through the agency of the Tuberculosis Care Committees and the Invalid Children's Aid Association all orthopædic cases, on discharge, are referred with an abstract of the case-paper to the hospital they attended before admission, or, if they were not attending a hospital, to the nearest hospital with an orthopædic department. We are deeply indebted to the surgeons who kindly undertake the task of supervision. The appliances worn on discharge have been made in the hospital workshop, and are capable of adjustment to the growth of the patient. If notification is received that any repair or alteration is needed an appointment is made for attendance at Carshalton, and whatever the magnitude of the alteration or repair it is completed the same day.

Section of Pathology.

President—JAMES MCINTOSH, M.D.

Modern Trend of Prophylactic and Therapeutic Immunization and Its Interpretation:

PRESIDENT'S ADDRESS.

By JAMES MCINTOSH, M.D.

ACTIVE immunization is now recognized as a very definite therapeutic and prophylactic practice in human medicine. Prophylactic vaccination, especially and particularly in respect to several common infective diseases, has been most thoroughly vindicated by the results achieved. Largely by its means small-pox has become rare and in well vaccinated countries has practically disappeared. One of the most striking features in the medical history of the Great War is the almost complete absence of typhoid fever as compared with the high incidence in former wars [1]. We are not, however, on such sure ground when dealing with therapeutic vaccination, for although in certain conditions very striking results have been obtained, yet in many infections failure must be recorded.

I propose first to make a short review of the literature of the subject in order that the main steps by which the process has advanced may be appreciated.

PROPHYLACTIC IMMUNIZATION.

It was known, even in ancient times, that a previous attack of an infective disease may render the individual resistant or immune to a second attack: this was the reason for the wilful exposure of children to infection and even to the actual inoculation of infective material. It is to Jenner, however, that the actual discovery of prophylactic immunization is usually accredited. The earlier workers on this subject all sought to obtain a modified and less virulent virus. Thus, in variolization, the introduction of variolous material under the skin seemed to reduce the virulence of the virus and to produce a less severe attack of the disease. Jenner, being familiar with the old Gloucestershire belief that an attack of cow-pox rendered man immune to small-pox, proved in his brilliant experiments the truth of this idea [2], and as a result of his experiments vaccination against small-pox gradually became general over the whole civilized world.

It is now known that the virus of small-pox can be attenuated by passage through animals, but whether Jenner used a true cow-pox or only a modified small-pox will never be known, nor does it matter greatly. At the present time it is generally believed that most strains of calf lymph are variolous in origin and, as such, are attenuated viruses.

Pasteur and his collaborators expanded the idea of Jenner and applied it to other infections both human and animal.

For many years it was firmly believed that the use of living but attenuated virus was essential to the production of a good prophylactic immunity, which of course greatly restricted its application to human medicine. Gradually, however, this belief has broken down; in the nineties Haffkine [3], with his plague vaccine, and Wright [4], with his typhoid vaccine, broke completely away from this idea and used dead instead of living virus. Previous to Wright's work on typhoid fever attempts to induce immunity by inoculations of dead bacteria had been merely tentative and incomplete. It is chiefly to Wright, therefore, that we owe the knowledge that killed cultures provide an efficient means of producing immunity.

The success of prophylactic vaccination against typhoid fever has already been noticed, but it is equally successful against many other infections, including dysentery, cholera, plague and pneumonia.

During the past few years we have seen attempts to simplify the prophylactic injection still further by employing, where possible, simple bacteria products, toxoids, and even aggressins, as in the prophylactic inoculation against diphtheria [5], scarlet fever, and other infections [6]. The toxin is modified by the addition of antitoxin or chemical substances. Thus we see that the general trend of medical progress has been in the direction of dropping the use of living virus for the dead virus or for some of its products. In immunization against rabies, killing the virus by heat, carbolic acid, ether, &c., have in many Institutes replaced the original dried cord method of Pasteur [7]. There is now only one human disease, i.e., small-pox, in which the injection of the living virus is still widely used to procure an immunity. Apparently the Jennerian method is still employed for want of a more reliable one, or is it that the prophylaxis of this particular disease has been so bound down to a fixed procedure that stagnation has followed? Scientifically, it cannot be disputed that from every point of view the injection of virus capable of multiplying in the body of the individual is bad. When multiplication of the virus occurs, then there is no possibility of estimating the dose to which the patient has been subjected. Thus, the effect cannot be controlled, and in susceptible individuals this may lead to unforeseen results. It can, of course, be argued on statistical grounds that the likelihood of bad effects after small-pox vaccination is infinitesimal and not worth consideration: but is this really so? It has recently been shown that nervous disabilities (meningo-encephalomyelitis, &c.) may follow vaccination, either as a direct effect or as a sequel to the lowering of the general resistance of the body [8].

From time to time attempts have been made to re-introduce the use of an attenuated living virus as a prophylactic measure in certain other human diseases; particularly is this true in regard to tuberculosis [9]. This, I am sure, is an innovation which should be rigorously opposed and regarded as a retrograde step: who knows for how long an attenuated bacillus can lie dormant, and then assume its former virulence?

Therapeutic Immunization.

For the introduction of bacterial immunization as a curative measure, we are indebted to Wright [10] and his collaborators. This form of vaccine therapy is, however, really a development of prophylactic immunization, but I think that most of you will agree that it has not proved so successful. Once it was hoped that vaccine treatment controlled by opsonin estimations would yield therapeutic success rivalling the results of prophylactic immunization. This hope has been disappointed.

At the outset, the originators of this form of therapy insisted on the specificity of the reaction and emphasized the use of specific vaccines. At the present moment there is a tendency for the pendulum to swing the other way and it is said that there is nothing in this vaunted specificity. Let us analyse this contention under the heading of non-specific therapy.

Non-Specific Bacterial Therapy.

As I have just pointed out, Wright's original vaccine therapy is based on the principles of strict specificity. But it was frequently observed that rapid improvement followed almost immediately on the injection of a single dose of vaccine, a fact which could not be explained on any of the known phenomena of immunity. This was first noted as long ago as 1893, when Fränkel treated cases of typhoid fever with typhoid vaccine [11], and Rumpf treated them with *Bacillus pyocyaneus* vaccine [12].

It is now recognized that other substances, particularly of a proteid nature or origin, can bring about similar phenomena. It would appear that a stimulus is liable to follow on the injection of any substance which might be regarded as a

foreign proteid. My own attention was first drawn to this reaction when investigating with Dr. P. Fildes the causation of saline fever in relation to salvarsan therapy. In 1912, Dr. Fildes and I noted that the rapid healing of leg ulcers, chronic eczema, &c., frequently took place after an injection of what we then believed to be normal saline [13]. Subsequent investigation demonstrated that saline prepared from ordinary distilled water contained large numbers of dead bacteria—bacteria which are able to grow in distilled water. The injection of such saline intravenously gave rise to considerable reaction on the part of the patient, which we may now regard as protein shock. Generally within half an hour of the injection the patient manifested a rigor followed by a rise of temperature of from 2° to 3° C., with headache, nausea or vomiting, and a rapid pulse. The temperature reached its maximum in about three hours' time, and then, accompanied by sweating, it slowly fell to normal. In about eight hours' time the patient's condition was again normal, and, as already mentioned, the healing of various skin lesions was greatly stimulated. At the present time a considerable amount of success has followed the application of non-specific proteid therapy in such disorders as chronic ulcers, chronic eczema, and rheumatoid arthritis. This line of treatment must also be regarded as a direct development of specific vaccine therapy. The dosage must be sufficiently high to produce a well-marked tissue response, which is apparently preceded by a temporary depression of the defensive mechanism of the body. That large doses of vaccine have this latter effect was well known to Wright, who noted the depression of the opsonic index—termed by him the negative phase. It was undoubtedly the fear of producing this negative phase that prevented the use of larger doses of vaccine, and who is bold enough to say that a more heroic dosage might not have given a better therapeutic result—at any rate in the subacute or chronic infections? We know that although the smaller dose may produce immune bodies, it does not always cure the patient. The application of large doses of vaccine to those conditions, such as tuberculosis, where there is a hypersensitiveness to the antigen, is inadmissible on account of the intense reaction which is liable to follow. When used in larger dosages, specific vaccines produce the typical protein shock of non-specific therapy. The general consensus of opinion seems to be that non-specific or protein shock therapy has come to stay, since in many subacute and chronic infections it has given striking therapeutic results. The effect, as already indicated, is mainly due to the stimulating effects of a foreign proteid or proteid derivative, and the curative effects of such remedies as normal horse serum, Coley's fluid in sarcomata or a concurrent infection, are all attributable to the same phenomenon; may it not be that some of the effects of colloidal lead in malignant disease are much of the same nature? At the present moment it would appear that the success attained by non-specific therapy has reacted against the use of specific vaccines, and there has followed in some quarters a tendency to minimize the old belief in the value of specificity. But from a scientific point of view, this is quite erroneous, as the specific vaccine can cause both the specific and non-specific reactions, so that by its use a double effect is produced.

The Mechanism of Bacterial Immunization.

This now brings us to the second part of my address, namely, the nature of these specific and non-specific reactions with which I have just dealt.

Specific Immunization.

With regard to specific immunization, immunologists now recognize that resistance to infection following the use of vaccines depends mainly on two factors:—(1) The production of specific antibodies. (2) The sensitization (allergie) of the tissues to the virus. For instance, after antityphoid vaccination antibodies can be demonstrated in the serum for several years afterwards, and even after these can no

longer be demonstrated the tissues are still sensitized—as shown by the rapidity with which antibodies can be produced after an injection of antityphoid vaccine.

Dr. L. E. H. Whitby, working in my laboratory, showed that antibodies (agglutinins) were readily demonstrated several years after a prophylactic antityphoid inoculation.

Non-specific Therapy.

In spite of a considerable amount of research work into the phenomena of non-specific vaccine therapy, the answers obtained have been rather indecisive. In an indefinite sort of way the effect is accredited to leucocytic action, to an increased flow of blood and lymph, to antiferments, antibodies, phagocytosis, &c. One very definite fact, however, is established, namely, that in most instances the injection is followed by a leucocytosis. As a series of observations on antibody production, which I made quite recently, in conjunction with Mr. A. N. Kingsbury, and a later unpublished series made with Dr. Whitby, have some bearing on the explanation of this reaction, I propose to give some account of them here. The phenomena observed may be readily grouped under three headings: (1) General tissue reaction; (2) leucocyte response; (3) immunity or antibody response.

(1) The *General Tissue Response* is apparently dependent on the pyrogenetic properties of the foreign (bacterial, &c.) proteid, as we found was the case in saline fever. This reaction, I think, must be regarded as a process identical with that which occurs in the fever which accompanies a natural infection. Fever, of course, is now regarded as part of a protective process and not to be suppressed—as was the practice at one time. During a fever response the general metabolism is increased, circulation is quickened and the flow of lymph is increased. In this way there is an increased flow of all the protective substances through the tissues of the body together with an increased rate of removal of waste and toxic substances. The effect, in its broadest sense, is therefore comparable to the old-fashioned poultice or to a fomentation. Such a reaction alone is bound to stimulate the healing of various lesions.

(2) The *Leucocyte Response* is very definite. It consists, first of all, of a diminution (leukopenia) within an hour of the injection, which is immediately followed by an increase, till within twenty-four hours there is a well-marked leucocytosis (polynuclears). The effects of a protein shock, as obtained in non-specific therapy produced by the intravenous injection of a 1,000 million *Bacillus typhosus* vaccine into a rabbit, are shown in fig. 2.

It has been stated that this non-specific effect is mainly the result of the interaction of one type of colloid with another, and it has been claimed that colloidal metals have a similar effect. In our hands the response to the injection of colloidal metals has always been much less than that produced by an organic colloid. Fig. 3 shows the effects of an injection of 0·05 grm. of colloidal silver intravenously injected into a rabbit. Perhaps much of this stimulation is due to the organic colloid used to protect the inorganic colloid. In the case of the guinea-pig the injection of colloidal silver seems at times to have rather a depressing effect, as at the end of seven days the leucocytes had fallen to about one-third of their number—no doubt as the result of the toxic action of colloidal silver.

(3) *Antibody Response.*—Under this heading the effect on both the natural and immune antibodies has been considered.

(*a*) *Natural Antibodies.*—In this connexion certain writers, in particular Jobling and Petersen [14], claim that following an injection of foreign proteid, an increase in the ferments and antiferments of the body can be demonstrated. But on their own showing, the percentage increase is small and unlikely to be of much value. It seems more probable that the increase observed is in some way or other bound up

Section of Pathology 5

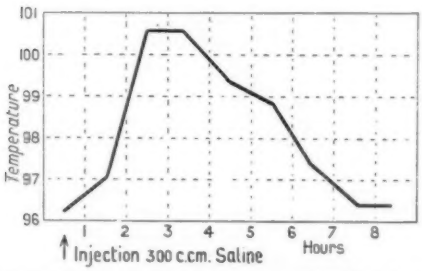

FIG. 1.—Shows the temperature curve of saline fever produced by the injection (intravenous) of 300 c.c. of saline—not made from freshly distilled water.

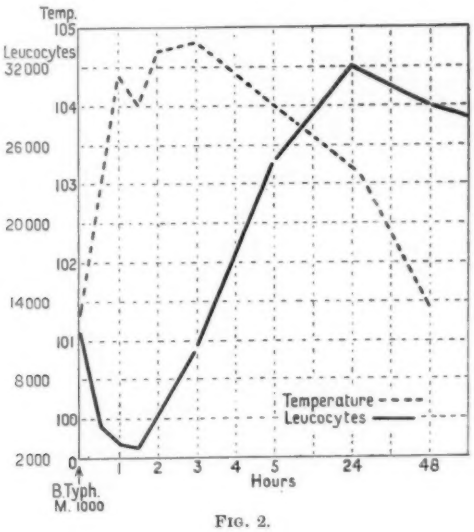

FIG. 2.

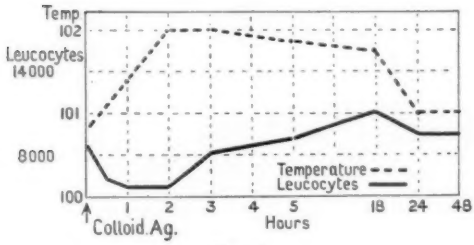

FIG. 3.

with the leucocytosis, as the curves given by these writers follow very closely those of the leucocytosis.

Estimations of the opsonic index have likewise given very little information. Ledingham and Bulloch, with injections of nuclein [15], claim a temporary increase

of opsonins of 50 to 100 per cent. My own experiments have never shown a very definite increase, and in some cases a depression has been noted with bacterial vaccines.

On the blood-complement, injections of vaccine, apart from a slight depression, had no distinct effect (fig. 4), but injections of colloidal silver caused a considerable diminution.

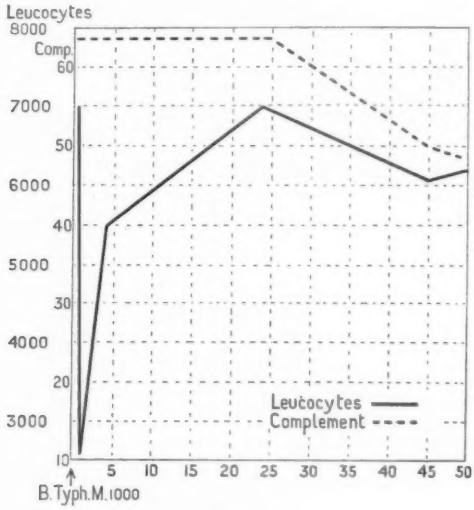

FIG. 4.

(*b*) *Hæmobactericidal Power.*—The antibacterial power of the blood after foreign protein injections was estimated by the slide-cell method of Wright, Colebrook and Storer [16]. In the first experiment detailed below, a rabbit was injected with 1,000 million *Bacillus typhosus* intravenously and staphylococcus used as the implant. Estimates were made before the inoculation, one hour, and eighteen hours after. The results, as calculated from the percentage of surviving colonies, show a slight increase (30 per cent.) in the killing power of the blood, eighteen hours after the injection (Table I).

TABLE I.—WHITE RABBIT: 1,000 MILLION *Bacillus typhosus* INTRAVENOUSLY. IMPLANTED *Staphylococcus aureus*.

(A) Implanted per c.c. of blood. (B) Number implanted (I) and found (F) per 50 c.mm. blood. (C) Percentage of survivors.

Before inoculation				1 hour after				18 hours after			
(A)	(B)		(C)	(A)	(B)		(C)	(A)	(B)		(C)
	I	F			I	F			I	F	
2,500	125	88	70 } Av. 83	2,500	125	113	90 } Av. 93	4,500	225	100	44 } Av. 50
1,250	62·5	56	89	1,250	62·5	60	96	2,250	112	52	46
625	31·2	28	90	625	31·2	29	93	1,125	56	34	60
312	15·6	18	100	312	15·6	19	100	562	28	28	100
250	12·5	22	100	250	12·5	20	100	450	22·5	22	100
Totals	246·8	212	86	—	246·8	241	97	—	433·5	236	54
Leucocytes: 13,800				2,200				33,400			

Section of Pathology 7

A similar experiment, in which colloidal silver was injected and staphyloccus used as the implant, gave a somewhat similar result (Table II).

TABLE II.—LYTIC POWER. RABBIT NO. 5. INJECTED 1,000 MILLION *Bacillus typhosus*, Rawlins.

Fifteenth day. Bacterial suspension diluted (*Bacillus typhosus*).

	$\frac{1}{10}2$	$\frac{1}{10}3$	$\frac{1}{10}4$	$\frac{1}{10}5$	$\frac{1}{10}6$	Colonies	Average
	(Agglutination titre 1 in 2,500)						
Suspension control	+ +	7,200	910	120	20	Col.	—
Complement control	+ +	8,400	1,200	132	18	,,	—
Serum, 1 in 20	+ +	7,124	672	64	3	,,	—
Percentage reduction	—	1	56	47	85	,,	47
Whole blood, 1 in 20	+ +	8,200	640	72	7	,,	—
Percentage reduction	—	—	31	40	65	,,	45

Sixteenth day. Injected 1 c.c. colloidal silver (0·05 grm.).
(Agglutination titre 1 in 320)

Suspension control	+ +	10,400	1,520	184	19	Col.	—
Complement control	+ +	+ +	1,624	203	22	,,	—
Serum, 1 in 20	+ +	+ +	980	87	8	,,	—
Percentage reduction	—	—	35	53	58	,,	48
Whole blood, 1 in 20	+ +	+ +	1,240	76	9	,,	—
Percentage reduction	—	—	18	57	52	,,	42

In forming an opinion of the value of these two experiments, the considerable technical difficulties must be taken into account; to my mind, after allowing for this, the increase of bactericidal power seems to be outside experimental error.

SPECIFIC ANTIBODIES.

It has been suggested that one of the main effects of non-specific therapy is produced by a flushing-out of the natural and specific antibodies. Hektoen [17], Conradi, Bieling [18] and others, found that the specific antibodies, agglutinins, &c., were increased after the injection of non-specific antigens. Other observers found no such increase—Lüdke, &c. [19]. An examination of the results of many of these workers suggests that, in their experiments, there is a tendency to lay stress on findings which cannot be regarded as significant.

In a series of experiments devised with the idea of elucidating this point, I could find little or no evidence that the specific antibodies were increased after the injection of a heterologous antigen or of an inorganic colloid. The results were similar to those obtained in the chemical stimulation of antibodies. The antibodies tested for were hæmolytic amboceptor, agglutinins and bacteriolysins.

The Effects of Colloidal Silica on the Amboceptor Titre of a Rabbit Immunized against Sheep Corpuscles.

An injection of 1 c.c. of colloidal silica intravenously gave no appreciable rise of titre, as shown in (fig. 5, p. 8). Similarly, injections of bacterial vaccines were without effect (fig. 6, p. 8).

[Professor McIntosh then proceeded to give an account of these various experiments and showed that injections of heterologous antigens were without appreciable effect on the antibody titre. He showed how one agglutination curve can readily be superimposed on another without interference (fig. 7).] He continued: Let us glance back for a moment at what seems a discrepancy between the findings in the bactericidal and hæmobactericidal experiments. The hæmobactericidal results show a slight increase after the injection, while the bactericidal results show no change. In the first place quite different techniques are employed in these two estimations—in the former test the whole blood is used, and in the latter the serum.

If we accept, for the sake of argument, that the results are correct because they fall in line with the experiments of other workers, then in the whole-blood experiment the leucocytes present are bound to play an important part in the destruction of the test bacteria. After these shock-producing injections the leucocyte-producing tissues are stimulated, and as a result young and vigorous leucocytes are present in greater

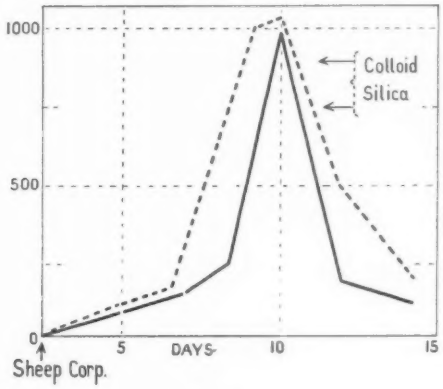

FIG. 5.

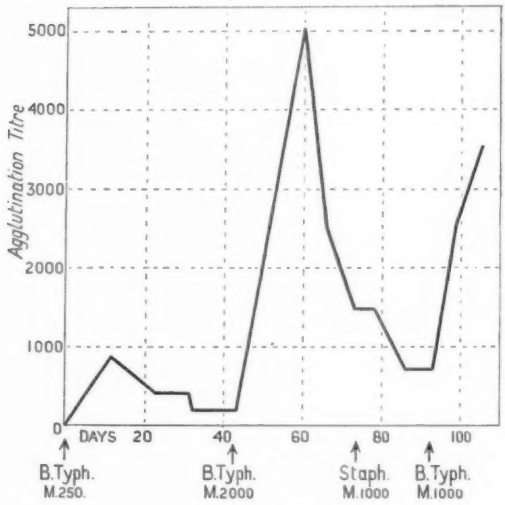

FIG. C.

numbers than before. These leucocytes then exert an increased phagocytic and ferment action. The importance of the leucocyte in this respect has been demonstrated in recent articles by McLean and by Maitland [22].

I think, therefore, that it may be said that no satisfactory evidence has been brought forward to show that non-specific protein therapy owes its main effects to

the stimulation of antibodies—normal or immune. Thus the theory that the substance injected may act as a common antigen, or stimulate the tissues which elaborate the antibodies, has found no support. Non-specific antigens I find have no measurable effect on the antibody titre, and as was shown before, pure chemical substances are without effect on the elaboration of antibodies. The curative effects of non-specific antigens apparently depend chiefly on the general tissue reaction and the leucocyte response.

All experiments have further confirmed the specificity of true immunity reactions, which indicates that the full value of therapeutic immunization can only be obtained by the use of specific antigens.

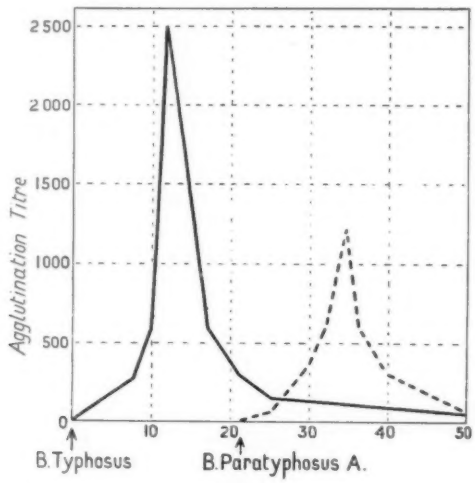

FIG. 7.

SUMMARY.

It would appear, therefore, that in both prophylactic and therapeutic immunization in man, the general trend has been towards simplification. Gradually the living attenuated virus antigen has been replaced by a dead virus or bacterial product, and the dosage accurately controlled. In prophylactic immunization the protection afforded apparently depends mainly on the specific antibodies elaborated, and on the sensitization (allergie) of the tissues.

In therapeutic immunization two factors are at work—a specific and a non-specific. The specific is a typical antibody response, while the non-specific appears to be mainly dependent on a general stimulation of the tissues and leucocytes—in fact to a process comparable to fever, while it is to be noted that in recent years there has been greater tendency to make use of the valuable non-specific response.

REFERENCES.

[1] "Medical History of the War—Pathology," London, 1923, p. 212. [2] JENNER, E., "An Inquiry into the Causes and Effects of the Variolæ Vaccinæ," London, 1798. [3] HAFFKINE, WM., "Remarks on the Plague Prophylactic Fluid," *Brit. Med. Journ.*, 1897, ii, p. 1461. [4] WRIGHT, A. E., and SEMPLE, D., "On Vaccination Against Typhoid Fever," *Brit. Med. Journ.*, 1897, i, p. 256. [5] PARK, W. H., "Toxin-antitoxin Immunization Against Diphtheria," *Journ. Amer. Med. Assoc.*, 1922, lxxix, p. 1584. [6] DICK, G. F., and DICK, G. H., "Scarlet Fever Toxin in Preventive Immunization," *Journ.*

Amer. Med. Assoc., 1924, lxxxii, p. 544. [7] McKENDRICK, A. G., "Rabies," *Trop. Dis. Bull.*, 1926, xxii, p. 195. [8] TURNBULL, H. M., and McINTOSH, J., "Encephalo-myelitis following Vaccination," *Brit. Journ. Exp. Path.*, 1926, vii, p. 181. [9] CALMETTE, A., GUÉRIN, C., NÈGRE, L., and BOQUET, H., "Prémunition des Nouveau-nés contre la Tuberculose par le Vaccin B.C.G.," *Ann. de l'Inst. Pasteur*, 1926, xl, p. 89. [10] WRIGHT, Sir A. E., "On the Therapeutic Inoculation of Bacterial Vaccines," *Brit. Med. Journ.*, 1903, i, p. 1069. [11] FRAENKEL, E., "Ueber specifische Behandlung des Abdominaltyphus," *Deutsche med. Woch.*, 1893, xix, p. 985. [12] RUMPF, T., "Die Behandlung des Typhus abdominalis mit abgetödteten Culturen des *Bacillus pyocyaneus*," *Deut. med. Woch.*, 1893, xix, p. 987. [13] McINTOSH, J., FILDES, P., and DEARDEN, H., "Salt Fever and the Treatment of Syphilis by '606'," *Zeitschr. f. Immunitäts. u. exp. Ther.*, 1912, xii, p. 164. [14] JOBLING, J. W., and PETERSEN, W., "The Non-specific Factors in the Treatment of Disease," *Journ. Amer. Med. Assoc.*, 1916, lxvi, p. 1753. [15] LEDINGHAM, J. C. G., and BULLOCH, W., "An Experimental Enquiry into the Relationship of Leucocytes to the Opsonic Content of the Blood," *Studies in Pathology*, Aberdeen, 1906, p. 321. [16] WRIGHT, Sir A. E., COLEBROOK, L., and STORER, *Lancet*, 1923, i, pp. 365, 417, 473. [17] HEKTOEN, L., "Precipitin-production in Allergic Rabbits, *Journ. Infect. Dis.*, 1917, xxi, p. 277. [18] BIELING, R., "Untersuchungen über die veränderte Agglutininbildung mit Ruhrbacillen vorbehandelter Kaninchen," *Zeitschr. f. Immunitäts.*, 1919, xxxviii, p. 15. [20] LÜDKE, H., "Ueber Albumosen-therapie," *Berl. klin. Woch.*, 1920, lvii, p. 344. [21] McINTOSH, J., and KINGSBURY, A. N., "On the Reputed Chemical Stimulation of Antibody Production," *Brit. Journ. Exp. Path.*, 1924, v, p. 18. [22] MAITLAND, H. B., "On the Mechanism of the Bactericidal Power of Blood in Slide Cells," *Brit. Journ. Exp. Path.*, 1926, vii, p. 161.

War Section.

President :—Group-Captain HENRY COOPER, D.S.O., R.A.F.

The Wider Aspect of Service Medical Work.

PRESIDENT'S ADDRESS.

By Group-Captain HENRY COOPER, D.S.O., R.A.F.

I GATHER that the Council are anxious to restrict further subdivision of the Royal Society of Medicine into Sections, and to encourage inter-Section discussions on subjects of mutual interest; and further, that their policy with regard to such discussions is not that the openers should read papers or theses on the subjects proposed, but that they should put forward briefly such points as they consider will afford good ground for discussion and be likely to elicit valuable views or information. With this policy to guide us I think it would be well to consider the aims of our own Section and to take a survey of our position.

We are the War Section, and our chief function is to thresh out during peace time all questions open to debate which can affect the conduct of our affairs in future wars; to perfect in peace the machinery for dealing with the problems which may face us later. Our watchwords should be "Forethought" and "Foresight." By careful consideration of past experiences and thoughtful deliberation on future eventualities we may arrive at such a visualization of our needs as will enable us to make successful preparations for them.

To this end we have a double line of interests to follow :—

(1) The preservation of the health of the three fighting services and the maintenance of the highest possible degree of physical and mental efficiency therein.

(2) Consideration of the forces which will be placed under our charge and the medical officers who will be called upon to assist us in the event of war.

The personnel now serving are but the nucleus of the greater forces which will be called into operation in the event of another world war, and I feel very strongly that we who are at present the officers of this nucleus should keep those greater potential forces and their well-being constantly in mind.

The chief duty of medical departments of the three fighting services consists in the selection, maintenance, and development of physically-fit fighting forces. It is right that we should continue our efforts to improve the present state of health of those under our charge, but we must look ahead and see something beyond a healthy Navy, Army, and Air Force.

A great war calls for the entire resources of the healthy adult population of the nation, and the size of the population will not save us unless it is a fit population. The interests of the War Section therefore are national, and the subjects which we discuss should have a bearing upon this question of those forces of the future as well as upon our existing Services.

The general responsibility for the maintenance of national fitness is vested in one of the great ministries of the Government, and whilst it is not possible or desirable that we should trespass on their sphere of activity, we must realize that *our* interests are very intimately concerned with the success of *their* efforts.

How, then, can we get into closer touch with the life of the nation in these matters, what are the problems which should interest us, and how can we assist in their solution? These questions are not easy to answer categorically, and I can only submit as suggestions a few general lines upon which persistent, quiet work may produce much ultimate good.

First, with regard to the meetings of this Section of the Royal Society of Medicine, the policy, which I have mentioned as that of the Council of the Society, to encourage inter-Section discussions should be of great value to us if we can select suitable subjects.

To indicate just a few of the possible subjects for discussion with other Sections, we might take, say :—

(*a*) "Preventable Deformities," with the Sections of Orthopædics and Diseases in Children.

(*b*) "The Early Discovery and Treatment of Heterophoria," with the Section of Ophthalmology.

(*c*) "The Effects of Middle-ear Disease on Efficiency in Civil and Military Life," with the Section of Otology.

(*d*) "Preparations of Drugs and Dressings in Forms Suitable for Emergency and Field Work," with the Section of Therapeutics and Pharmacology.

(*e*) "Preservation of Efficiency in Tropical Climates," with the Section of Tropical Diseases and Parasitology.

(*f*) "The Early Diagnosis of Active Service Neuroses as a Check on Their Development," with the Section of Psychiatry.

These are all rather broad generalities but they could be kept within bounds by limiting the titles to some selected aspect of the subject for discussion on any one occasion.

With regard to papers read by members of our own Section at our meetings, I feel that whilst dealing, as so many of them must, with our present work and experience, they should wherever possible touch on the application of their principles to the need of national economics.

Secondly, I think there is a broad scope for us in the way of individual effort outside these walls, where the fringes of our Service medical work interlace with those of the work of the civil profession.

I have frequently heard the complaint that in Service life there is a lack of sufficient professional work, and a consequent tendency for Service medical officers to become rusty. This view, to my mind, arises from a failure to grasp the wider aspect of Service life. The medical officer who thinks that his whole work begins and ends with the letter of the law as laid down in the King's Regulations is bound to sink into a narrow groove and to become almost mechanical in the execution of his duties. "The groove, and how to keep out of it!" would be a good theme for an appendix to the medical officers' handbook. I think that if such were ever written we should find that one of its main instructions would be the cultivation of a closer liaison between medical officers of the fighting services and their professional brethren in civil appointments and private practice. It should be the desire of every medical officer to get into touch with the local civilian medical men; to attend, if his Service duties permit, the meetings of the local branch of the British Medical Association, to endeavour to interest the civil profession in the problems of Service life and work, and conversely, himself to take an interest in the labours of his civil colleagues and their endless work for the betterment of the nation.

I feel quite sure that if the point were put to them it would interest local branches of the British Medical Association to have occasional papers read before their members by a medical officer of one of the Services, papers, for example, dealing with such subjects as the more common causes of rejection amongst recruits and the possible reduction of such rejections by treatment in early life. Then, in the discussions following papers

read by other members of branches, a serving officer might be able to throw new light on the subject discussed and stimulate new interest by reason of his special knowledge of the standards required for efficient national service, of the trades embodied in the several State services and of the particular qualities demanded by each trade, and the risks involved in it.

The problems which should claim our interest follow the natural course of life. To begin at the beginning, our attention naturally turns to the production of healthy infants, which involves the eradication, so far as is possible, of hereditary disease and inherited susceptibilities; and the extension of the good work which is already being done towards the achievement of healthy maternity and of infant welfare. We must continue our efforts to reduce the incidence of venereal and tuberculous disease in the Services and also do our best to further a close liaison with the civil medical authorities in regard to such cases when they pass into civil life, so that their danger to the community may be reduced as far as possible.

We must study the measures adopted by the State for the supervision of school children. I feel strongly that in all schools children should be given definite courses of instruction in those rules of individual and collective hygiene which determine a healthy community. The opportunity to imbibe such principles is already open to thousands of our young people through the admirable medium of the Boy Scout and Girl Guide movements, which are doing so much for Young England to-day. Further, I think we should lay special stress upon a deeper knowledge of these matters being imparted to those who are likely to become the officers of a future army—I mean to the boys of our public schools.

Just as in the Services all drafts are examined on arrival and before departure, so I think that all boys should be overhauled at the beginning and end of each term, and medically categorized in their school reports. All training for sports and games should be done under the supervision of the medical officer, who would not only be able to avert cases of over-strain but also to suggest to the boys such exercises as would best help their development and fit them to succeed in the games of school and the work of the world. A medical officer should also be available to hold classes in sanitation and hygiene and to give such instruction to the boys as would be of great advantage in ordinary civil life and invaluable to them as officers in the event of war.

The interest of the War Section in the health of the community from infancy to adult life should be prolonged to embrace a keen desire for the welfare of all adults of service age, and any projects for the improvement of conditions of life should have our immediate sympathy.

Many people quote the presence of the enormous crowds attending football matches between teams of paid athletes as a sign of the degeneration of a formerly athletic race. I do not believe it; many in those crowds have neither the time nor the opportunity to become experts at games even if they had recreation grounds to play upon: most of them have also been hard at work all the week and are therefore presumably physically fit to carry on their employment though they may not be in such good condition as we could wish. Our outstanding thought is that these crowds which gather weekly all over the country represent the armies of the future, the men of whom we may be called upon to take medical charge, with the help of the many civilian doctors who at present look after them.

It is therefore all to our interest that we should work for a progressively closer intimacy between the Service and the non-Service worlds. In every business of life, the personal touch counts for much, and though some of you may think that I am labouring this question of liaison, I think myself that it would be difficult to over-estimate its importance, if only it is exploited in the right way. We should also remember that *for our own professional good*, for the widening of our education, and

for the absorption of experience, which is of more value than much book-learning, frequent association with the civil branch is of inestimable value to us all.

Finally, to the recently qualified newly-joined medical officer, I would say: Do not forget that though we have to do a considerable amount of paper work in the Services the local civil practitioner does not welcome a share of it; if you have to correspond with him on a Service matter let him down as lightly as you can; he is apt to be busy all day and most nights: if you can settle a matter by seeing him, do so, and get to know him: you will find a wealth of valuable knowledge and experience very freely at disposal for your acceptance if you greet your civil brethren with the hand of friendship to soften the necessary formalities of Service correspondence.

JOINT DISCUSSION No. 1.

Sections of Medicine, Surgery, Laryngology, and Electro-Therapeutics.

Chairman—Dr. HUGH THURSFIELD (President of the Section of Medicine).

DISCUSSION ON THE DIAGNOSIS AND TREATMENT OF INTRATHORACIC NEW GROWTHS.

Dr. L. S. T. BURRELL.

A FEW years ago a discussion on intrathoracic new growths would have been of academic interest only. An uncommon condition but rarely diagnosed, at any rate until the very late stages, and when diagnosed untreatable. The condition, however, is not so rare as was supposed, and with improved methods of diagnosis many cases are now recognized which formerly would have been considered to have been cases of some other disease, usually tuberculosis. These tumours may be considered under three headings: (1) Those of the mediastinum. (2) Those of the pleura. (3) Those of the lung.

In all cases the growth may be primary or secondary, malignant or benign. In the case of secondary tumours the diagnosis is as a rule easy, but they are generally beyond cure. A primary growth, however, may often be successfully removed by operation, even if malignant. The benign tumours, especially, lend themselves to successful operation, and as these usually increase in size and eventually prove fatal, it is very important to deal with them in the early stages.

TUMOURS OF THE MEDIASTINUM.

Sarcoma is the most common primary growth, but a secondary carcinoma is frequently found. Of the non-malignant cases fibroma and dermoid are the least uncommon. Sometimes the tumour grows very rapidly, so that even after a few weeks the whole chest may be a mass of new growth. In the late stages of course the diagnosis is obvious. In the early stage the first sign is the result of pressure. Some time ago I saw a man who complained of swelling of the veins of the right side of the neck when he stooped; otherwise he was quite well. I could find no physical signs, but suspected mediastinal tumour from the symptom, and X-ray examination showed a mass in the superior mediastinum. He had a course of X-ray therapy, but the tumour spread and he died seven months after the first symptom. Post mortem he was found to have an enormous sarcoma in the mediastinum, involving most of the right lung and the pericardium, with secondary masses in the left lung. In this case the diagnosis was made early, and I much regret that I did not consult a surgeon.

In the second case the patient complained of swelling of most of the joints, was unable to walk, and was wheeled into the hospital as a case of rheumatism. He denied cough or any chest symptom, but as his fingers were very clubbed I suspected an intrathoracic lesion, and on examination found dullness between the scapulæ and a very obvious d'Espine sign. X-ray examination showed a large mediastinal mass. After treatment with X-ray this mass disappeared and all the joint symptoms cleared up, though the clubbing remained. He kept well for about a year, when enlarged glands appeared in the groins and were found to be lymphadenomatous. In this case the growth had reached such a size that it could readily be recognized by clinical examination, before any symptoms except the arthropathy

had appeared. In the first case the pressure signs came before any physical signs could be detected. In both cases, however, X-ray confirmed the diagnosis. Pleural effusion usually appears early in these cases, but not as a rule until other signs have been noticed. Dyspnœa and pain are also early symptoms, but may be absent until the late stages. There is, indeed, no early sign or symptom which is constant, but one should always be on the look out, and the slightest symptom suggesting pressure in the mediastinum should make one very suspicious. Having made the diagnosis, it is important to exclude syphilis or aneurysm as the cause, and if these can be excluded I think a surgeon should be called in as soon as possible.

Tumours of the Pleura.

The type most frequently here seen is endothelioma. Usually the first symptom is dyspnœa, which is found to result from a large pleural effusion. I saw a case last year in a boy aged 20. He suddenly developed what was thought to be a bad cold, and went to bed owing to increasing dyspnœa. Pleural effusion was found and was aspirated many times, but the fluid always re-formed rapidly, and he died six months after the onset of the first symptom. In this case the diagnosis was made (and it was confirmed at the post-mortem) solely on the quantity of the fluid and the rapidity with which it formed. The fluid was clear throughout in this case, but usually it becomes blood-stained sooner or later. On the other hand, I have frequently seen a blood-stained effusion which was not caused by neoplasm. It is often blood-stained in cases of tuberculosis.

Tumours of the Lung.

Primary carcinoma of the lung occurs in about 1 per cent. of all cases of carcinoma. It is said that tuberculosis is a predisposing cause, and certainly this disease is often present in cases of carcinoma of lung. Moreover, in 80 per cent. of cases the upper lobe is involved, so that the diagnosis may be made with the greatest difficulty, especially if tubercle bacilli are present in the sputum. If a diagnosis is made early enough carcinoma of lung may be, and has been, successfully treated by operation. In order to arrive at an early diagnosis it is important to be on the look out for neoplasm; many cases are missed because they are never suspected. Secondly, we should rid ourselves of the old fallacy that the absence of tubercle bacilli in the sputum means nothing. In any case of pulmonary disease where there is sputum, repeated failure to find tubercle bacilli should lead one to suspect—and very strongly—that the disease may not be one of pulmonary tuberculosis, even if the signs are definite and confined to the apex of a lung. Thirdly, whenever the signs or symptoms are unusual neoplasm should be suspected. It should not be forgotten that in some 90 per cent. of cases the disease starts in a bronchus.

Bronchoscopy, therefore, is of the greatest value in the early recognition of these growths. Not only is it sometimes possible to see the growth, but a suspicious piece of the bronchial mucosa may be removed for microscopical examination. To illustrate some points in diagnosis, I will give a brief account of a case of carcinoma of lung that I saw recently. A woman, aged 55, had been ailing for eighteen months, and had been worse since an attack of influenza five months previously. She had lost 2 st. in weight, had night sweats, and a cough with purulent, blood-stained sputum. She had been advised to go into a sanatorium several months before but had refused. Now, however, finding herself worse, she had consented to go, and it was with a view to arranging sanatorium treatment that she came to me. On examination I found that the signs were confined to the left lung. In front, from the clavicle to the third space, crepitations were heard, the breath sounds were bronchial and the percussion note impaired. Below this, as far as the fifth space, the breath

sounds were absent and the percussion note stony dull. Now the history was quite typical of tuberculosis, but there were two facts which made the diagnosis doubtful. The first, that tubercle bacilli had never been found in the sputum; and the second, that the signs, although at the apex, were not those usually found in tuberculosis. The patient was therefore admitted to hospital and an X-ray was taken, which I now show on the screen. You will see a definite dense, round shadow in the middle of the left lung. This mass was clearly a tumour, and it was important to decide whether it was in the lung-tissue or not. Some lipiodol was injected into the trachea with the patient lying on the left side, and you will see in the next X-ray the left bronchus well defined for a short distance, when it suddenly ceases to be visible. It can also be seen that the lipiodol has overflowed into the normal right bronchial tree. So far the case appeared to be one of carcinoma of lung with occlusion of the bronchus. An artificial pneumothorax was induced, and it was found that the lung collapsed around the mass, as is seen in the next X-ray. Examination with the thoracoscope showed the presence of a large neoplasm in the lung-tissue. Owing to the size of the growth, the length of the history, and the bad general condition of the patient, it was decided not to advise an operation. The patient died shortly afterwards, and at the post-mortem there was found a large carcinoma of the lung with occlusion of a large bronchus, as was shown so well after the injection of the lipiodol. Just before death she developed a secondary growth of the brain—not an uncommon site in these cases. I did not have a bronchoscopic examination made because the diagnosis was clear without one, but had the condition been suspected a year earlier the growth would probably have been detected by the bronchoscope, and she might have been saved by operation.

I have been able to do little more than touch upon my subject from the physician's point of view. Mr. Roberts is to speak after me, and I have left it to him to discuss the surgical methods and the chances of life they offer to the patients. As a physician, however, I must emphasize the fact that however dangerous an operation may be, it is our duty to weigh this danger against the danger of leaving the patient alone, which in almost all of these cases is certain death. Operation cannot be expected to succeed when metastases have appeared, and they start early. I should say, then, lose no time in confirming your diagnosis, and when once it is confirmed call in a surgeon and do not waste time in giving a trial to radium or any other form of treatment. Moreover, remember that non-malignant growths such as a dermoid or fibroma often prove fatal if left too long.

I have laid stress on the value of the X-ray in diagnosis, and have pointed out how the introduction of lipiodol or the induction of a pneumothorax may assist the X-ray, but I have left it to Dr. Stanley Melville to describe this part of the subject in detail; and especially as regards treatment. In my experience X-ray therapy is very good in cases of lymphadenoma and should always be employed in them. For other forms of intrathoracic growth I have found X-ray and radium therapy disappointing, but they should be tried in cases which are inoperable. When operation is possible, it should be tried first.

With regard to drugs, except in the case of gumma (and I have warned you that syphilis must be excluded before coming to a final diagnosis) they are of value only in alleviating symptoms.

In these cases the great function of the physician is to make an early diagnosis, and for this purpose I should say the most important factors are to suspect the unusual in every case of chest disease, and not to rest satisfied with a diagnosis, however probable, until it is absolutely confirmed after a complete examination.

4 Roberts: *Diagnosis and Treatment of Intrathoracic New Growths*

Mr. J. E. H. Roberts.

Dr. Finney, of Baltimore, is reported to have said, in regard to intestinal obstruction, "it is more important to operate early than to operate well." In the case of intrathoracic tumours there is not the same degree of urgency, but, until the diagnosis is made at an earlier stage than is at present usual, treatment will be, in the case of malignant tumours, merely palliative, and in the case of innocent tumours more difficult and more risky than it need be.

As long as the occurrence of tumours within the chest is regarded as a rare event, the possibility will not be forward in the examining clinician's mind, and early cases of tumour will go unsuspected. Operative surgery has now reached a stage in which it is possible to attack with confidence and without undue risk both innocent tumours and some malignant tumours in their earlier stages. It is to be hoped that as a result of discussions such as this, the early signs and symptoms of carcinoma of the bronchi and of the lung will be studied and looked for, and suspected cases submitted to special methods of examination, such as: (1) X-ray examination in several directions, with sometimes the aid of artificial pneumothorax, barium in the œsophagus, lipiodol in the bronchi, &c.; (2) bronchoscopy; (3) thoracoscopy; (4) blood examinations, complement-fixation tests, &c.

I propose to confine my remarks to neoplasms and not to refer to retrosternal thyroids, enlarged glands, &c.

Innocent neoplasms are certainly rarer than malignant new growths, but now that the chest is so frequently X-rayed they are being detected in larger numbers. I have myself seen six cases in the last three years, and the cases reported in the literature are becoming commoner. Dermoid cysts and fibromata appear to be the commonest, the former generally in the anterior mediastinum, the latter in the posterior. Neurogangliomata, lipomata, and encapsuled endotheliomata occur more rarely. They remain without symptoms some years, but eventually as they enlarge they cause pressure symptoms, and eventually all lead to the death of the patient. I believe that an innocent tumour, which is discovered accidentally before it gives rise to symptoms, should be removed, as in that stage operative risks are at a minimum, and in fact are no greater than those of many abdominal operations which are performed daily.

There are two main modes of access: (1) Transpleurally by a long intercostal incision; (2) by a sternum-splitting operation.

The second method is followed by a smoother convalescence and is suitable for tumours filling the apex of the chest, where a preliminary thoracoscopy has shown that the lung is not adherent to the tumour.

The first method is preferable for tumours of the middle and lower parts of the chest, as better access is obtained and, if necessary, part of the pleura and capsule can be removed with the tumour and the orifice so made closed by suture. It has the disadvantage that the operation is often followed by the formation of a sterile pleural effusion which requires aspiration.

Primary sarcoma of the lung or mediastinum is best treated by X-ray or by the implantation of radium. Final cure is not to be expected.

Primary carcinoma of the lung appears to have been becoming commoner during the last ten years. It is certainly not a rare condition in the sense, say, that lymphatic leukæmia is rare. It occurs in two main forms: (1) The commoner one commencing in a bronchus; (2) the rarer form commencing in the parenchyma. In either case constriction of the lumen of a bronchus follows with, at first, absorption of the air beyond, and then retention of secretions followed by bronchiectasis, lung-abscess and empyema. At the present time the surgeon is generally asked to see a case of carcinoma of the lung in the stage of infection. In the last seven years I have seen

at least a dozen cases of primary carcinoma of lung in which the diagnosis has been lung abscess, bronchiectasis, &c. I think that progress is never made in diagnosis until treatment becomes available. The fact that surgical methods of treatment are carried out inside the abdomen has opened up the diagnosis of intra-abdominal tumour in its early stages; and now that the surgeon is beginning to show that he can do something, and that he hopes in the future to be able to do more, in the removal of intrathoracic growths, those who see these cases early will begin to suspect that possibly a new growth may be present, and set to work to prove whether one is present or not. There is always the difficulty that the patient may not come under observation until the late stages; but I think that in the future when a patient is seen in the early stages, with a constriction of the bronchi which may be due to new growth, it may be that this cause of the auscultation and percussion signs will be more in the physician's mind. It is only in the early stages that there can be hope for successful surgical treatment, either by the laryngologist through a bronchoscopy, or by the surgeon at operation on carcinoma of the lung. Experimental work has shown that resection of uninfected lobes of the lung can be carried out without any great mortality; but that when gross infection is added, the mortality is high. In New York, in thirty-seven amputations of lung for bronchiectasis, there was a mortality of something like 50 per cent. If malignant disease could be diagnosed before infection occurred, the mortality from the operation ought to be comparatively low.

The parenchymatous growths, though rarer, are more amenable to surgery. Sauerbruch has resected lung in five cases; one patient with a carcinoma of the lower lobe the size of a small fist was alive five years later. A second patient, also with a carcinoma of the lower lobe in whom a part of the diaphragm was also resected, was alive three years later.

The *palliative* treatment of carcinoma of the lung consists in drainage of pulmonary abscesses and of secondary empyemata; bronchostomy in order to drain dilated bronchi, &c. These palliative operations are well worth doing, as they render the patient much more comfortable and prolong life for many months.

In some cases the growth undergoes necrosis and a sterile abscess results. Again relief follows incision and drainage. I have no experience of implantation of radium into carcinoma of the lung, and X-ray treatment in my experience has not been helpful.

I will now describe some illustrative cases with the aid of lantern slides.

[Among the cases then described by Mr. Roberts were the following:—

Case I.—A man aged 48 was being examined by his doctor for some trivial ailment, when an area of dullness was discovered to the right of the sternum. An X-ray (fig. 1) showed a tumour. A further X-ray, taken two months later, showed that the tumour had slightly increased in diameter. There were no symptoms due to its presence. The tumour was successfully removed by a transpleural thoracotomy and was found to be an encapsuled endothelioma. Fig. 2 shows the same case after operation.

Case II.—A fibroma causing sympathetic paralysis of eye, face and arm, for seventeen years. There had been increasing dyspnœa for three years. The radiogram (fig. 3) was taken after a partial pneumothorax had been induced, thus enabling the outline of the tumour to be seen all round. The growth was successfully removed by a sternum-splitting operation. Fig. 4 shows a true lateral view of the same case and demonstrates the posterior position of the tumour.

Case III.—A dermoid cyst in a woman who had been under treatment for supposed pulmonary tuberculosis for four years. No tubercle bacilli had ever been found in her sputum. Fig. 5 shows the cyst in an antero-posterior view. Fig. 6 the same in true lateral view with barium in the œsophagus. The cyst is seen to be anterior. It was removed successfully after a preliminary drainage operation.

FIG. 1.—Encapsuled endothelioma of mediastinum.

FIG. 2.—Same case as fig. 1 three months after operation.

FIG. 4.—Same case as fig. 3 in true lateral view, showing posterior position of tumour.

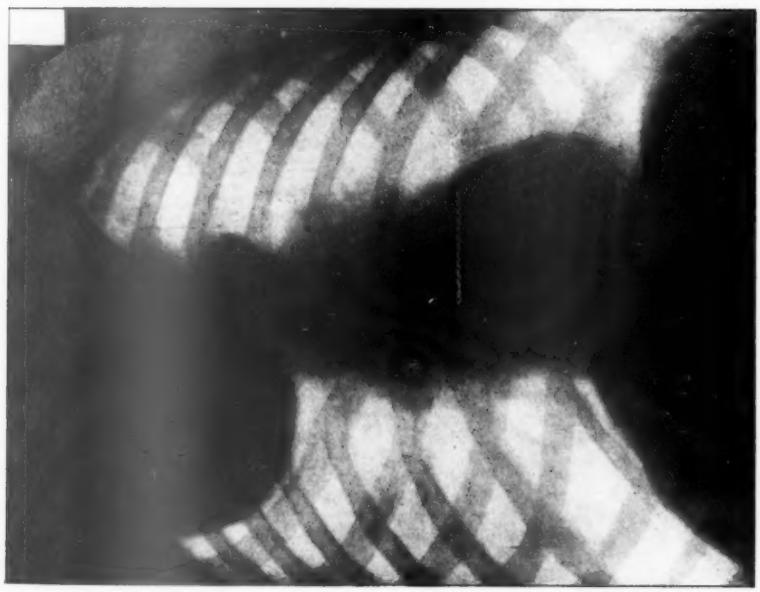

FIG. 3.—Intrathoracic fibroma which had caused sympathetic paralysis of eye for seventeen years.

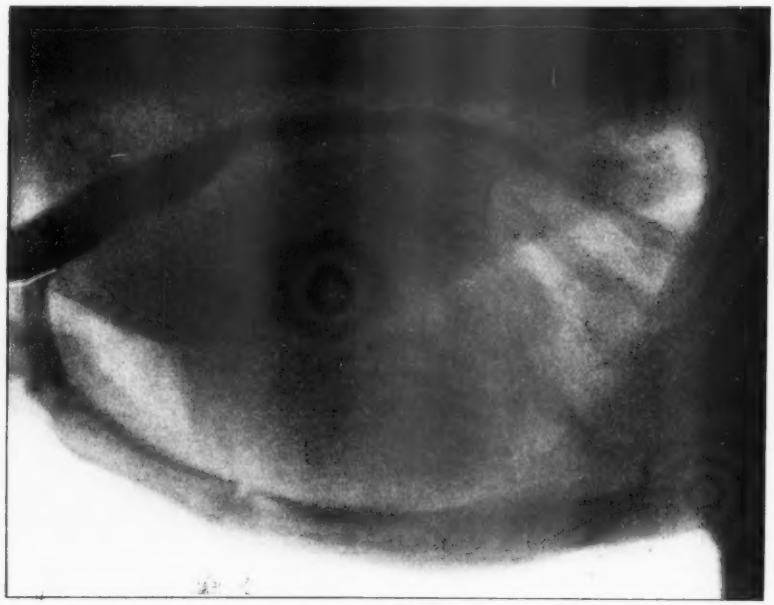

FIG. 6.—Same case as fig. 5 in true lateral view with barium in œsophagus, showing anterior position of tumour.

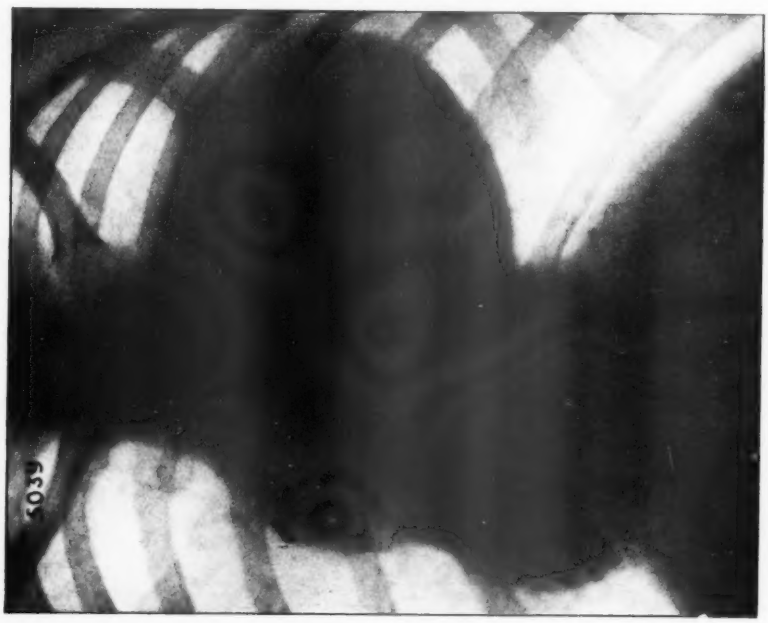

FIG. 5.—Mediastinal dermoid cyst.

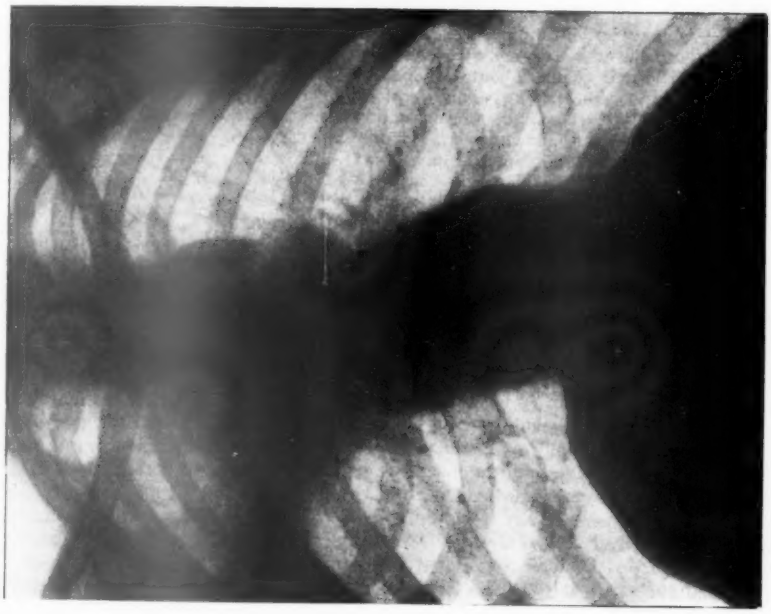

FIG. 8.—Primary carcinoma of bronchus. The outer part of the shadow is due to absorption of air.

FIG. 7.—Primary carcinoma of lung.

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Case IV.—A very large fibroma weighing 5¾ lb. This was a very late case. The capsule of the tumour was extremely vascular and in microscopical section resembled a venous nævus. The patient died about 1½ hours after the operation, though probably if she had had a blood transfusion, as she would nowadays, she would have survived. The case illustrates the necessity of removing innocent growths in their earlier stages if undue risks are not to be taken. X-ray is shown by Dr. Melville (fig. 1, p. 14).

Case V.—A primary carcinoma of the lung (fig. 7). This shows a late stage of the peripheral type of carcinoma. The diagnosis was established by exploratory operation, but the growth was too advanced for removal to be attempted.

Case VI.—A primary carcinoma of the bronchial type (fig. 8). The outer part of the shadow was found, post-mortem, to be due to absorption of the air in the lung and only the inner part to be due to growth. There were secondary growths in many parts of the body.

Mr. Somerville Hastings.

Intrathoracic new growths become known to the laryngologist (1) by the occurrence of laryngeal symptoms due to pressure of the growths on the vagus or its branches; (2) by pressure of the growths on, or by their involvement of, the œsophagus; (3) by their obstructing the lumen of the trachea or bronchi.

(1) Involvement of the pneumogastric nerve by a mediastinal tumour may give rise to paroxysms of coughing with severe attacks of suffocation [1]. More usually, however, the symptoms are paralytic only and similar to those produced when the recurrent laryngeal nerves are involved. Owing to its longer course in the thorax, the left recurrent nerve is more frequently involved than the right. The first effect of pressure on these nerves is paralysis of the more vulnerable nerve-fibres going to the abductor muscles of the larynx. Later, the adductor fibres are also involved, and the cords are seen in the "cadaveric" position. In practice, however, the first stage is rarely seen when only one recurrent nerve is involved, and no dyspnœa is produced. There is at first some hoarseness, but very soon the healthy vocal cord learns to cross the middle line and take on the work of both, and the voice is but little affected in ordinary conversation. Laryngoscopically, the arytenoid is fixed with its tip tilted a little forward. The affected cord is in the "cadaveric" position, fore-shortened, and often paler than its fellow [2].

Where both recurrent nerves are involved, and when one or both are in the first stage of pressure, i.e., with the nerve-fibres to the abductor muscles only affected, considerable dyspnœa with noisy inspiration may result. Where the intrathoracic tumour is malignant and where, therefore, complete paralysis of both cords is certain, if the patient lives long enough, intubation is, in my opinion, much to be preferred. I have had two cases of malignant disease of the thyroid gland under my care, in which the severe dyspnœa resulting from the involvement of the recurrent nerves disappeared completely after a few weeks' intubation, as the destruction of the nerve-fibres became complete.

(2) Occasionally a mediastinal tumour may give the first indications of its presence by pressing on the œsophagus and causing difficulty in swallowing. In œsophageal obstruction much more accurate information can be obtained by the passage of the œsophagoscope than by an X-ray photograph after a barium or bismuth meal. This is especially the case when a mediastinal tumour is present, for should the slit-like crevice which takes the place of the lumen of the gullet be parallel to the photographic plate, the obstruction may pass unnoticed. But before passing the œsophagoscope the presence of an aneurysm must be excluded. To relieve obstruction, the passage of a Symonds' or a Souttar's tube may be necessary, or well-screened radium may be applied to the growth from the œsophagus. Gastrostomy is required but rarely.

(3) Sarcomata, lympho-sarcomata [3], aneurysms, dermoids, thyroid, and other tumours may press on the bronchi and cause obstruction; while from the interior of the trachea and bronchi, tumours reported as endothelioma [4], sarcoma [5], columnar-celled carcinoma [5], fibroma [6], and papillary granuloma [7] have all been removed. By getting the patient to bend well forward, the whole of the interior of the trachea to its bifurcation can generally be seen, and any encroachment on its lumen observed. Under local or general anæsthesia, the examination of the main bronchi can also readily be undertaken, and much help in diagnosis and treatment obtained. Chevalier Jackson [4] describes a case in which symptoms resembling chronic bronchitis or tuberculosis, with considerable dyspnœa, were due to an endothelioma of the right bronchus, which acted as a ball-valve. It was removed successfully and there has been no recurrence. Blumgarten [8] mentions a similar case, in which a pedunculated benign adenoma acted in exactly the same way and caused the death of the patient. He is frank enough to tell us that it could easily have been recognized and removed, and the patient's life saved, had a bronchoscopic examination been made. In skilled hands the risk of bronchoscopy is practically nil. Jackson [9] and his assistants have carried it out some 5,000 times without a death. Not only can the presence of a tumour within the trachea or bronchi, or pressure on these from without, be recognized, but infiltration due to malignant disease of the lung can also be detected [9] by the lack of elasticity of the bronchi and the absence of movement during respiration. Moreover, a small piece of tumour can in some cases be removed for microscopic examination [10]. By the insufflation of bismuth subcarbonate or lipiodol, the position of the bronchi can also be made out in an X-ray photograph.

But the bronchoscope is of value in treatment also. Killian [5] was the first to remove a sarcoma from the trachea without recurrence, by the direct method, with the galvano-cautery snare. Tilley [7] has successfully removed a papillary granuloma from the bifurcation of the trachea. Chevalier Jackson [4] has removed an endothelioma from the right bronchus, and Kahler [5] reports the excision of a columnar-celled carcinoma from the right bronchus by means of the galvano-cautery snare with no recurrence after two and a half years. Yankauer [6] has on two occasions successfully removed fibromata from the bronchi.

Radium may also be applied to a mediastinal tumour by way of the trachea or bronchi. Yankauer [6] applied to the interior of a bronchus, 50 to 60 m.c. of radium emanation contained in a metal capsule covered with rubber. It was introduced by the bronchoscope and a cord left hanging from the mouth. It was well tolerated, and after eight applications of four to six hours each, at intervals of a fortnight, marked improvement of the condition was noted. In 1920 a man of 58 was under my care for a new growth between the trachea and œsophagus. After two applications of radium to the interior of the œsophagus all sign of growth had disappeared from that organ. But extension in the direction of the trachea continued, and a fungating mass appeared on its posterior wall. At the suggestion of my house surgeon, I tied two fish-hooks to a tube containing 50 mgm. of radium bromide and passed it into the trachea by the direct method. It was quite easy to place it in position over the growth and the fish-hooks held it firmly. After six hours it was readily removed through the larynx by the cord attached to it. Unfortunately, only temporary improvement resulted. Chevalier Jackson reports benefit from intravenous injections of radium sulphate in watery suspension, and endo-bronchial injections of a suspension of the same salt in oil.

As the result of obstruction to the bronchi by new growths bronchiectatic dilatations often occur. Lung abscesses indicated by foul breath and expectoration may

follow. In such cases the comfort of the patient may be increased by lavage through the bronchoscope [12].

REFERENCES.

[1] DELESSERT, E., "A Clinical Study of Malignant Tumours of the Anterior Mediastinum and Thymic Region," *Internat. Clinics*, 1922, 32, ser. II, pp. 127-186. [2] SMITH, H., "Cyst of Mediastinum, probably Dermoid, with left Laryngeal Paralysis," *The Laryngoscope*, 1924, xxxiv, pp. 919-924. [3] ADAM, JAMES, "Lymphosarcoma of Mediastinum," *Journ. of Laryng.*, April, 1925, p. 270. [4] JACKSON, C., "Endothelioma of Right Bronchus," *Trans. Amer. Laryng. Assoc.*, May, 1916, p. 176. [5] KAHLER, OTTO, "History of Bronchoscopy," *Laryngoscope*, September, 1911, p. 898. [6] YANKAUER, S., "Lung Tumours treated Bronchoscopically," *New York Med. Journ.*, June 21, 1922, pp. 741-742. [7] TILLEY, H., "An Intratracheal Tumour: Removal by Peroral Tracheoscopy," *Journ. of Laryng.*, January, 1920, p. 1. [8] BLUMGARTEN, A. S., "The Diagnosis of Primary Lung Tumours," *Amer. Journ. Med. Sci.*, 1921, clxii, pp. 376-385. [9] JACKSON, C., and others, "Bronchoscopy as Aid to Thoracic Surgery," *Journ. Amer. Med. Assoc.*, 1925, lxxxiv, pp. 97-103. [10] FRASER, J. S., "Compression Stenosis of Bronchi and Œsophagus," *Journ. of Laryng.*, August, 1912, p. 450. [11] JACKSON, C., "Bronchoscopy and Œsophagostomy," 1922. [12] WILENSKY, A. O., "The Surgery of Thoracic Tumours," *Amer. Journ. Med. Sci.*, 1922, clxiv, pp. 573-587.

Dr. STANLEY MELVILLE.

Scarcely a century has elapsed since neoplastic diseases of the lung were first subjected to systematic examination. It is, however, less than thirty years since any such examination was made possible, *in vivo*, by means of X-rays. Bayle, a favourite physician of Napoleon, in his "Recherches sur la Phthise pulmonaire," in 1810, coined the term "phthise cancereuse." At this time a clinical diagnosis was not thought of, and it remained for Bell, of Glasgow, and Stokes, of Dublin, to point out the clinical symptom-complex of increased intrathoracic pressure.

In the pre-radiological days, publications on intrathoracic neoplasms were exceedingly rare, and, without exception, dealt with the matter from the standpoint of morbid anatomy only. Out of 174 cases recorded by Sehrt in 1904, in six only had a correct clinical diagnosis been made. There were good reasons for this clinical failure. In the first place, they were considered to be of extreme rarity; and in the second place, the absolute hopelessness of the prognosis was not conducive to any great enthusiasm.

About twenty months ago, the Section of Electro-Therapeutics suggested the subject of our discussion to-night as one likely to be of interest. The suggestion was turned down by a learned physician in the following words: "A discussion of this kind could only be of academic interest because the physician but rarely diagnosed the case, and if he did so the surgeon was, as a rule, helpless." Now in the nineteenth century this would have been quite a correct answer. At that time there was a physician and there was a surgeon—a very excellent duet. Laryngology was only just getting its full-grown feathers and radiology had only just come out of the shell. We are now no longer a duet but a very strong quartet, and though modesty requires me to say that the youngest member of the quartet has still much to learn, I am bold enough to say that given the most perfect, the most unselfish collaboration between all the members of the quartet, it will be seldom that a reasonable working diagnosis cannot be arrived at in the future.

BENIGN NEOPLASMS.

These are for the most part extra-pulmonary and the commonest is *fibroma*.

(1) *Fibroma.*—The X-ray evidence is that of a well-defined rounded opacity, which can be shown to spring from the posterior part of the thoracic wall and to push the lung in front of itself. I know that several examples of this tumour will be shown to-night. I will therefore only remark that a differential diagnosis can readily be arrived at by the simple and harmless method of collapsing the lung. I do not think this method has received the attention it deserves. In this country and in France, it is being made use of. In Germany and elsewhere I cannot find

this to be the case, and I suggest that many of the continental clinicians have been apt to mistake fibromata for fibro-sarcomata, thus erroneously increasing the number of cases of primary sarcoma of the lung.

(2) *Dermoid cyst.*—This is very difficult to diagnose from the radiological appearances only. These cysts are usually filled not only with hair, but with sebaceous material of such density as to occlude the view of other components such as fragments of bone, &c., though, in a cyst which was operated upon by one of my colleagues at Brompton Hospital the other day, it was possible to see a piece of bone on its being pointed out after the operation. The origin of these tumours is, I believe, from the third branchial arch, which produces the thymus; hence they must lie, or spring from the anterior mediastinum, in this way differing from fibromata.

Malignant Neoplasms.

(1) *Primary carcinoma.*—Speaking from my own experience, I must admit to being amazed at the apparent increase in the number of these cases. The table given below, although it is no doubt subject to the same disability as are all statistics, is sufficiently startling. It would appear that the incidence of primary carcinoma of the lung is somewhere about 4 per cent. of all carcinomata found in the body. I would ask: Is this increase real, or is it that many of the cases have hitherto been mistaken for pulmonary tuberculosis, especially of the fibroid type? I would suggest that the increase is real, and that proof of this is available. Friedländer and others have found squamous-celled carcinoma in the walls of a tuberculous cavity, and the experienced radiologist knows that the presence of definite tuberculous infiltration in a suspicious lung tends to confirm rather than to exclude his suspicions. As following other irritative lesions, such as chronic interstitial pneumonia and anthracosis (in the case of the cobalt miners of Scheeberg), the occurrence of primary carcinoma is well known. Almost without exception, the cases have an acute history to begin with, and the occurrence of primary carcinoma following any acute bronchial affection, and especially the bronchial influenzas, is well recognized. Berblinger, of Jena, supplies an interesting proof by drawing attention to the metaplasia of the epithelium which frequently takes place, and which results in producing a very favourable soil for development of neoplastic disease.

Statistics of Pulmonary Carcinoma.

Goldstein		
1886	Fuchs	1·27
1896	Passler	1·85
1897	Perutz	1·27
1901	Feilchenfeld	4·3
1902	Reichelman	3·8
1907	Otten	3·3
	Redlich	6·3
1913	Mielecki	3·5
1914	Brinckmann	5·6
1919	Bejach	4·8
1920	Briese	4·5
Schmoller		
1924	Bejach	6·3
	Brinckmann	5·6
1907-11	Kolszewski (Berlin)	6·0

—*Fortschritte f. R.*, January, 1924.

The figures represent the percentage of primary lung carcinoma relative to primary carcinoma of all other organs. The years correspond to the year in which the statistics were compiled and the name that of the compiler. Reckoning from the post-mortem statistics a similar increase appears to have occurred in the total number of lung carcinomas. According to the comprehensive statistics from Kraus-Brugsch, primary lung carcinoma is four times as common as primary lung sarcoma.—*Fortschritte f. R.*, March, 1924.

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Bronchial stenosis is usually the first result of invasion by a carcinoma, and this gives a striking X-ray picture which shows density of the affected lung area, displacement of the heart and mediastinum to the affected side, and raising and gradual paralysis of the diaphragm.

In the upper part of the lung a primary carcinoma is more readily recognized than when the affection involves the lower zone. The density of the mass and its absolute sharp delimitation by the interlobar pleura can only be confused with the appearance of a massive lobar pneumonia, but in the latter event the history will

FIG. 1.—Case of large intrathoracic fibroid tumour. The lung has been collapsed.

clear the matter up. In the lower zone, however, pleural involvement is so much more frequent and early that the distinction between carcinoma and other inflammatory affections is rendered more difficult.

In all cases pleural involvement and degenerative conditions may completely obscure all X-ray evidence. The former is similar to an ordinary pleural effusion, except that the heart and mediastinum are displaced towards the affected side in the case of neoplasm. The degenerative processes are indistinguishable from those of gangrene or bronchiectasis.

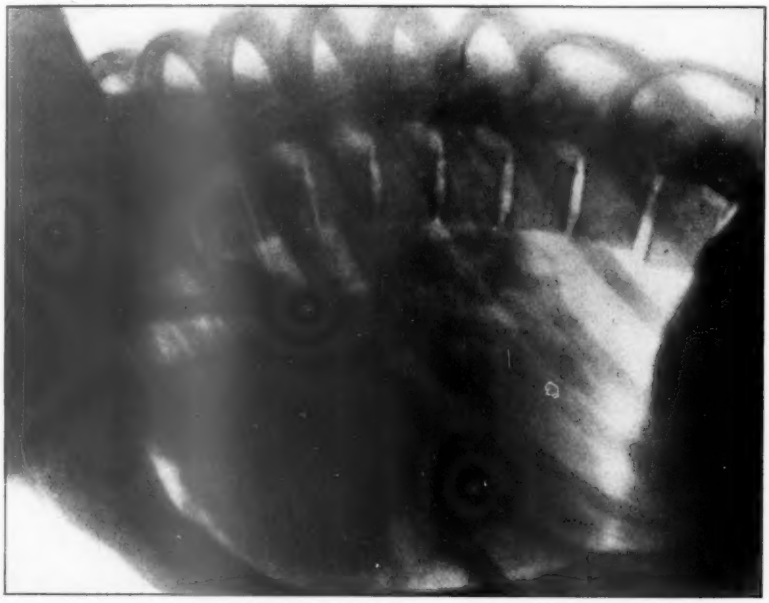

FIG. 3.—The same case taken in dead lateral plane; the tumour is seen to be growing from the anterior part of the thorax. A diagnosis of dermoid was therefore possible and this was confirmed at operation.

FIG. 2.—Tumour in the region of mediastinum on the left side.

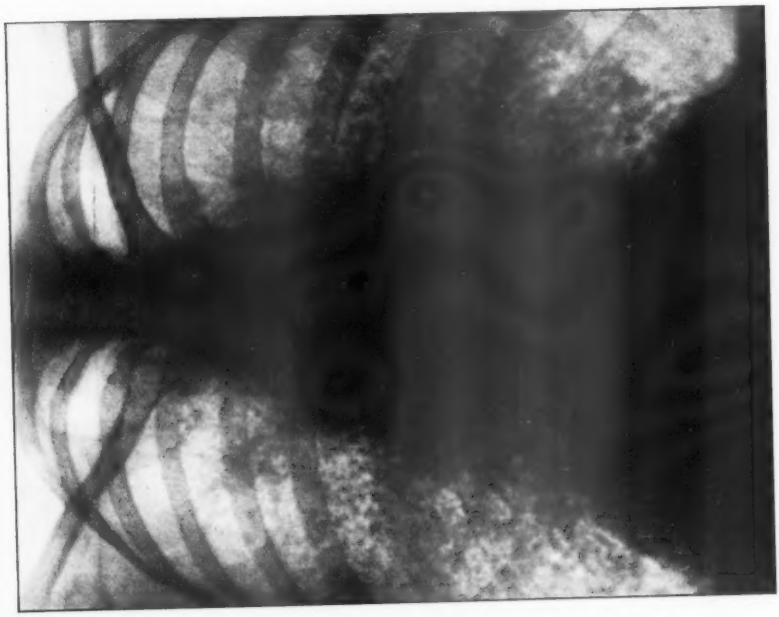

FIG. 5.—Case of miliary type of secondary carcinoma. The original focus was ovarian.

FIG. 4.—A large tumour in the left lung. The lung was partly collapsed and lipiodol injected into the trachea. The left main bronchus was stenosed and the lipiodol is seen to be abruptly arrested at this point. The case was obviously a large primary bronchial carcinoma.

(2) *Metastases.*—It is not possible to distinguish between the metastases of carcinoma and those of sarcoma from the X-ray appearances alone. Both appear as fairly well-defined rounded shadows implanted in more or less normal lung tissue. It has been suggested that, at first at any rate, the metastases from sarcoma are smaller, but I should not like to suggest that this distinction has been proved. They are, at any rate, more rapidly fatal.

(3) *Primary Sarcoma.*—I am anxious to learn whether it is generally agreed that primary sarcoma of the lung does actually exist. Of about ninety cases collected by Adler, very few of them appear to justify their separation from carcinoma. I have suggested one reason for a possible source of error, and it seems difficult at first sight to appreciate how a primary growth of this nature can well be intrapulmonary. In the usual sarcomata, growing from the bronchial or mediastinal glands, one knows how readily metastases take place in the lung itself. However, I understand that some undoubted cases have recently been operated upon, and if this be the case, it clinches the argument.

(4) *Mediastinal tumours.*—It is in the diagnosis of mediastinal new growths that the combination between clinician and radiologist is of vital importance. It is the duty of the radiologist to prove that the mass is not connected with the aorta, and this requires much patience, a good technique and meticulous care. He must be prepared to examine in the postero-anterior planes, in the oblique and in the true lateral diameter. The true lateral picture is not easy, but upon it depends the question of an enlarged middle lobe of the thyroid. This forms a long thin tongue-like process passing down into the anterior mediastinum and depressing the arch of the aorta. The radiologist must be ready to examine the posterior mediastinum by giving the patient an opaque meal, in order to demonstrate any pressure or divergence of the œsophagus as evidence of a mediastinal growth. If he is not satisfied, he must ask, if necessary, for the lung to be collapsed, and he must avail himself of the use of lipiodol in the bronchus, a method sometimes of great value in the diagnosis of tumours involving a bronchus.

I end as I began, with a plea for the abolition of water-tight compartments, for more team work and, above all, for free discussion. The work is difficult but intensely interesting, and it is my firm belief that before much more time has elapsed early diagnosis will be possible, and the era of successful intrathoracic surgery will have arrived.

Dr. Robert Knox.

Treatment of Intrathoracic Growths by Radium and X-rays.

Diagnosis.

Before submitting a patient to radiation treatment everything possible should be done to ascertain the precise nature of the tumour.

I have had well-marked cases of aneurysm of the aorta sent for X-ray treatment under the impression that the patients had a growth. Another interesting condition is that of a large accumulation of pleural fluid associated with malignant disease.

Evacuation of pleural fluid is an essential preliminary to radiation treatment:—

A typical case was dealt with, which, in the first instance, looked like a large tumour filling one side of the chest, and which had been diagnosed as growth. Tapping, followed by radiations, cleared up the opacity, and the patient survived for two years and there was no recurrence of the fluid.

In cases of neoplasm of the chest in which the nature of the growth is doubtful, we have found that a few exposures to X-rays have been helpful in clearing up the

diagnosis. The response of the tumour to the rays may give a definite indication of its nature. A lymphadenoma and sarcoma respond rapidly, while carcinoma rarely does so.

Technique.

My invariable practice in all cases of intrathoracic growth is to obtain a complete examination of the blood of the patient. Whenever possible some idea should be formed regarding the nature of the growth. Microscopic examination of a section of the growth is the most reliable guide, but this is not always possible.

When the growth occurs primarily in a bronchus, useful information can be gained from the radiographic appearances.

Radiographic examination is most useful as a guide to the method of attack, when treatment is decided upon. Radiograms should be taken in at least three positions: (1) antero-posterior; (2) postero-anterior, and (3) lateral or oblique. These give invaluable guidance for either operative or therapeutic measures, or a combined method of attack.

When radium treatment is advisable, the surgeon has a good idea of how best to approach the growth for the insertion of radium tubes or needles. For X-ray exposures a chart of the thorax and of the growth *in situ* should be prepared and compared with the radiograms. A scheme of treatment can then be arranged. This should be done from the anterior or posterior aspect, whichever is the shorter route, and from the lateral aspect. Cross sections of the thorax at the level of the growth are also useful for the planning of the route of the beam of rays, when X-rays are used. With charts prepared for experimental exposures the percentage of a beam of X-rays reaching a particular depth in the thorax can be calculated. When several ports of entry are used, the percentage from each beam which reaches the tumour can be calculated, and the total dose to be given determined accurately.

It is next a question as to which particular value is likely to achieve the best result. This will depend largely upon the experience of the worker, but approximate values have been reached.

The choice has to be made between X-rays and radium; the latter offers a measure of hope if the radium can be applied to the growth, and for this purpose a surgical operation is necessary. Radium might be used by surface applications, but a large quantity of the element would be necessary. However large a quantity of radium may be available, it may be asserted with confidence that, if particular wave-length X-rays can be used from a number of aspects of the body, a much larger dose of rays of considerable activity can be given in a very short time. A saturation dose can be administered in two or three hours to practically every portion of the growth. By "saturation dose" is meant the thorough irradiation of the tumour by radiations of sufficient intensity to call forth a satisfactory response.

In treating a case of malignant disease we need never think in terms of the lethal dose, for the past has shown that the attempt to deal with a large tumour by this method is almost invariably a failure, that the effect upon the patient is usually disastrous, and that, even if disaster is avoided, the patient suffers grievously.

The argument that in a grave case, if the end is inevitable, it is well to give the patient a chance by using a lethal weapon, is untenable, and extremely unscientific. It is useless to give such a dose when we know that the chance of recovery, or even of amelioration, is negligible. Yet in some advanced cases, thorough treatment will induce changes and improvements which are obtainable in no other way. From observations of tumour response to radiations—now extending over many years—it can be said that their use gives results which are striking, and leads one to the conclusion that radiations are most useful, but that unfortunately they are to a large

extent uncontrolled. It is well to remember that once a very large dose has been given there are no possible means of checking its effect; once initiated the changes in the tissues go on to the inevitable end. When judiciously controlled, however, much of the risk and discomfort is removed, and by careful observations of the effects and control of dosage beneficial results are obtained with relatively no discomfort or untoward happenings.

For these reasons I am opposed to the use of the large lethal dose at one sitting. To attempt to give a lethal dose to a large tumour is quite illogical, because of the difficulty the normal tissues have in coping with the destructive products set free. The rapidly growing sarcomata often respond in a remarkable way to doses far short of the lethal dose. Frequent exposures may be necessary at short intervals. A sarcomatous growth situated in the mediastinum can be irradiated from several aspects of the chest wall, and ports of entry are so arranged as to avoid as far as possible the giving an over-dose to the lung tissue.

Primary tumours are generally more responsive than secondary, for presumably a rapid development of secondary masses is an evidence that the normal resistance to the growth has broken down, and that a rapid dissemination has taken place. These cases are extremely difficult to check, and almost invariably proceed rapidly to the inevitable end.

Primary growths of the mediastinum may be attacked by either X-rays or radium; the latter may have to be buried in the growth, and this involves a surgical operation.

Several cases of this kind have been dealt with by a combined treatment: radium to the growth and X-rays from the surface—in one case in particular, in which surgical interference was used successfully for a time, and radium introduced into the growth on four or five occasions; the case was subsequently treated by X-rays, and the patient survived for nearly five years. This case has been recorded by Mr. Sampson Handley.

It is worthy of note that in this patient a later development of the growth nearly as large as the early tumour was successfully reduced in size by X-rays alone. The experience in this case has led us to believe that with X-rays alone all that is possible to retard growth can be done.

Carcinomata.

These are generally secondary, but occasionally primary, and are more difficult to treat. Primary tumours are more responsive if they are not very advanced, and the patient is not debilitated. Secondary carcinomata are not very responsive as a rule, because of the late stage of the disease, and the exhausted condition of the patient.

Malignant Disease of the Thorax with Associated Pleural Effusion.

These conditions are associated in a fairly large percentage of cases, particularly when the pleura is involved. If the effusion is a large one, the pleural sac should be tapped before treatment. It may be necessary to do this frequently during a course of treatment. Good results are occasionally obtained by the combined attack.

It would be idle to assert that radiation treatment of thoracic neoplasms is in a satisfactory position at the present time. Yet, reviewing the progress of therapy since its commencement, I can confidently assert that the position has improved, and that the near future may see more striking improvement in this respect. That marked improvements have been made in comparatively recent times is undoubted.

The chief advantage which has resulted from the publication of continental workers in relation to malignant disease, and the experience gained by all in their attempts to follow the technique, has been the establishment, however accurate or inaccurate the actual figures may be, of a definite ratio of response of particular

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types of tumour. The tissue sensibility of Seitz and Wintz was but the expression in words of what all experienced radiologists felt, since it has been recognized for years that some types of tumours responded better than others, and more or less in a definite ratio to the intensity of the X-rays and the response of the tissues.

Space does not allow of unlimited illustrations, but the skiagrams shown are sufficient to indicate the method of attack, aided in its formulation by radiographic studies: the response to radiations is shown in the cases illustrated in figs. 4 to 8, after radium and X-ray treatment, and in figs. 9 to 13 after X-rays alone, also in figs. 14 and 15; while in figs. 16 and 17 a case is illustrated in which no favourable response was obtained.

Description and Reference Numbers of Illustrations of Cases.

Figures 1, 2, 3 illustrate a lympho-sarcoma of the anterior mediastinum before radium treatment. Figures 4, 5, 6, 7 and 8—after radium tubes had been buried in the tumour mass on several occasions.

Figures 9, 10, 11, 12, and 13 the same patient at a later date with recurrence of the growth, and showing the effect of X-ray treatment upon the tumour.

FIG. 1.—Antero-posterior view of chest.

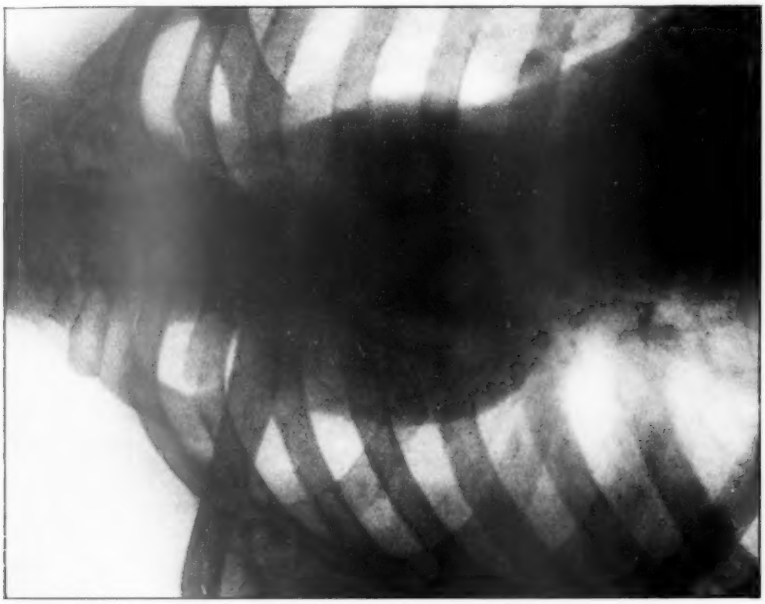

FIG. 3.—Semi-oblique view of chest showing mediastinal growth.

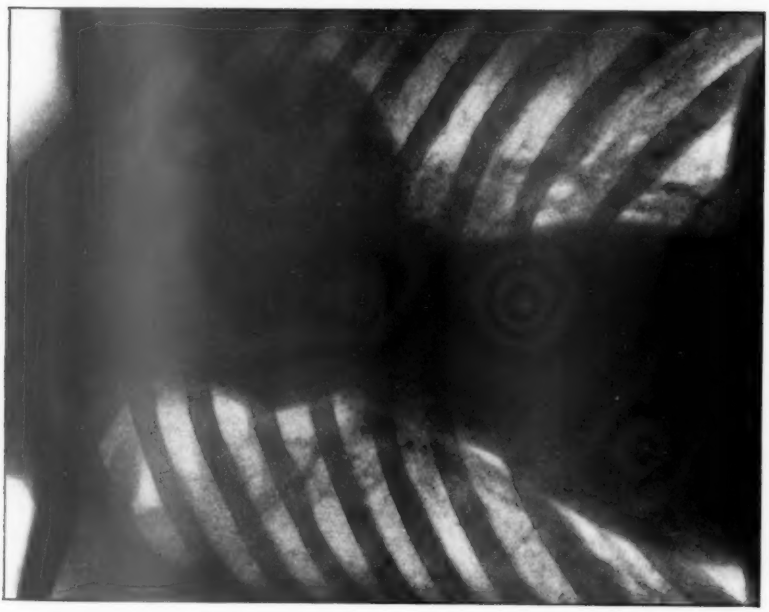

FIG. 2.—Posterior-anterior view.

FIGS. 1, 2 and 3.—Mediastinal tumours X-rayed in three positions.

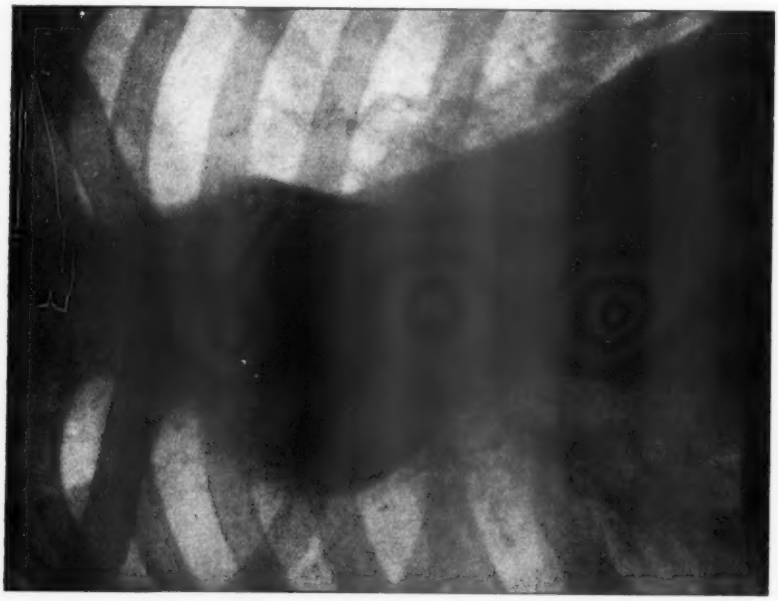

FIG. 5.—August, 1920.

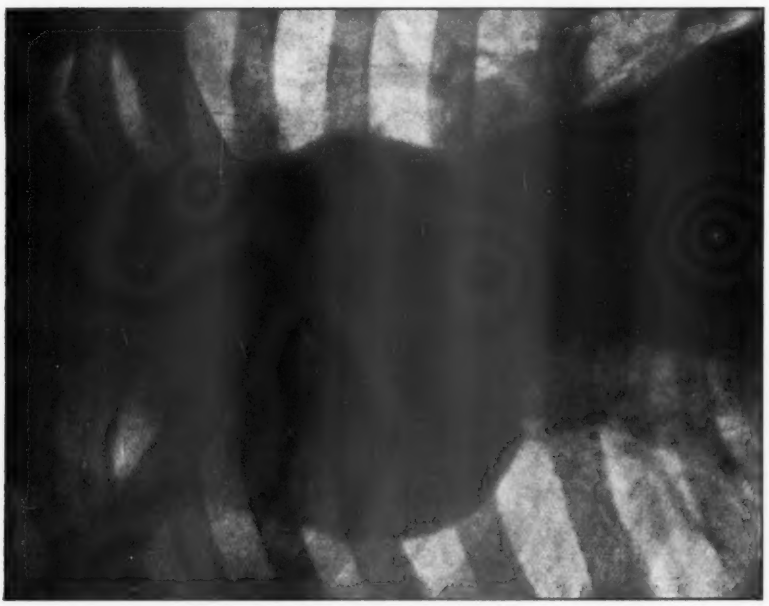

FIG. 4.—July, 1919.

Series: Figs. 4-8

FIG. 4.—July, 1919.

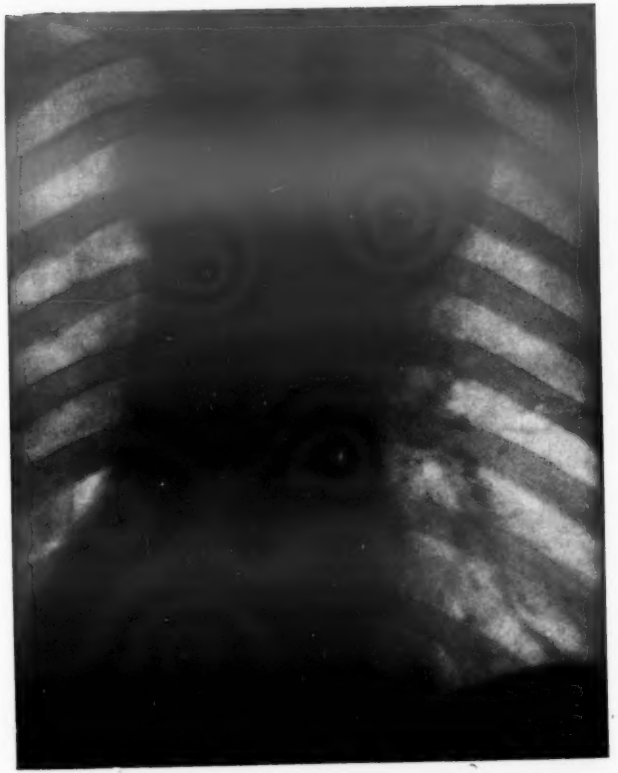

FIG. 6.—November, 1921.

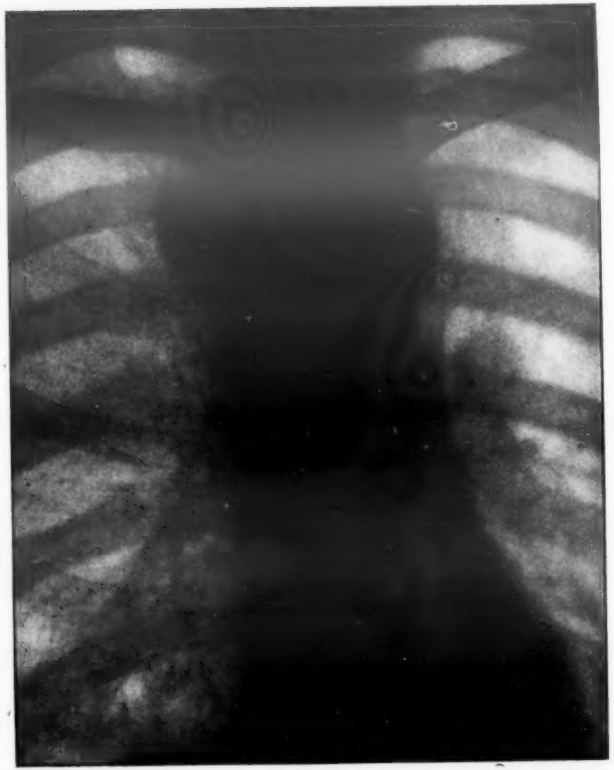

FIG. 7.—January, 1922.

FIGS. 4, 5, 6, 7, and 8.—From same patient, treated by radium buried in tumour on four occasions—showing progress of the condition from July, 1919, to February, 1922. The patient also was given X-ray treatment after the radium exposure.

Series : Figs. 9-13.

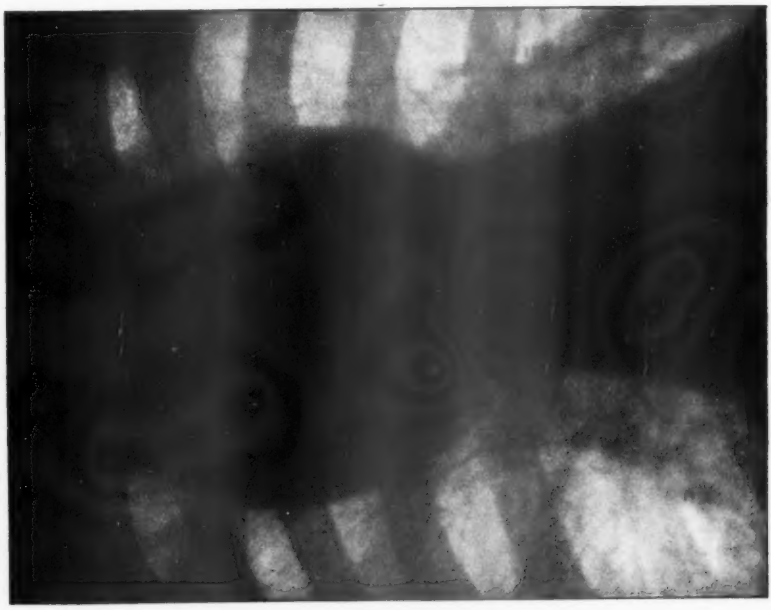

FIG. 9.—April 6, 1923.

Series : Figs. 4-8.

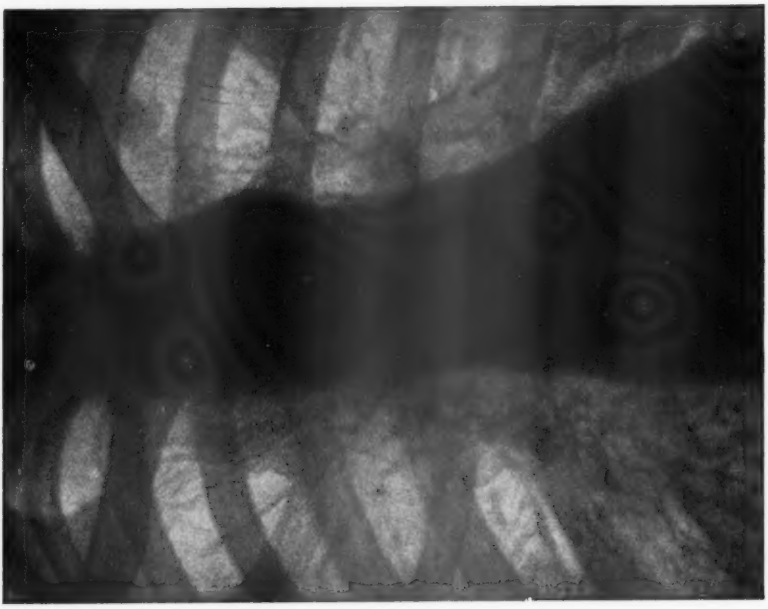

FIG. 8.—February, 1922.

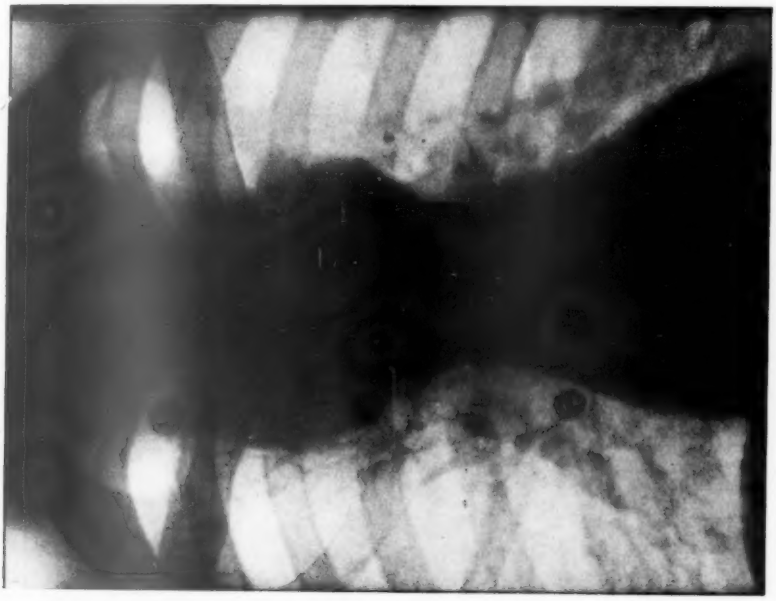

FIG. 11.—April 30, 1923.

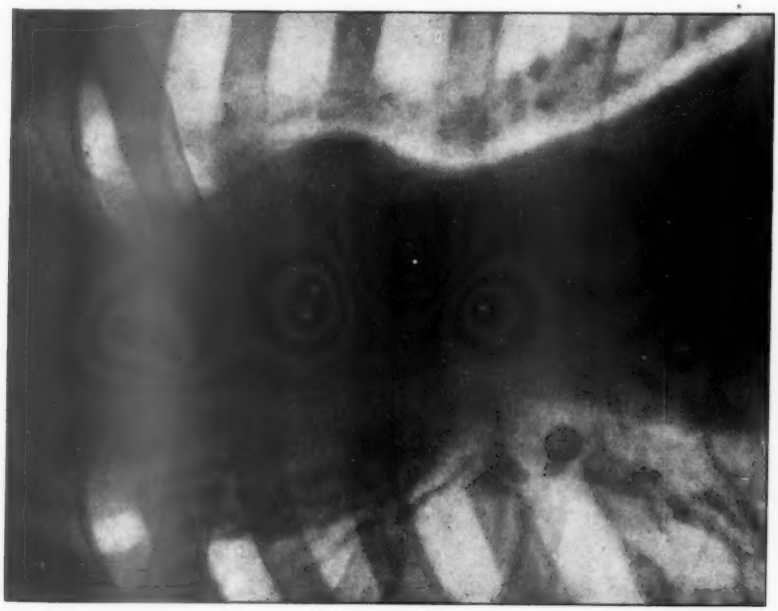

FIG. 10.—April 12, 1923.

FIGS. 9, 10, 11, 12 and 13.—Recurrence of growth in same patient treated with X-rays only. Showing progressive diminution of growth.

FIG. 8.—February, 1922.

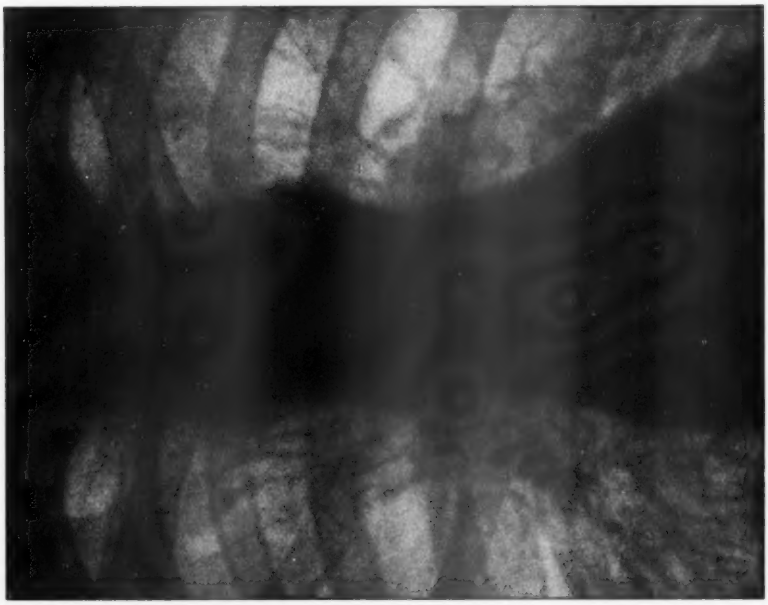

FIG. 13.—June 18, 1923.

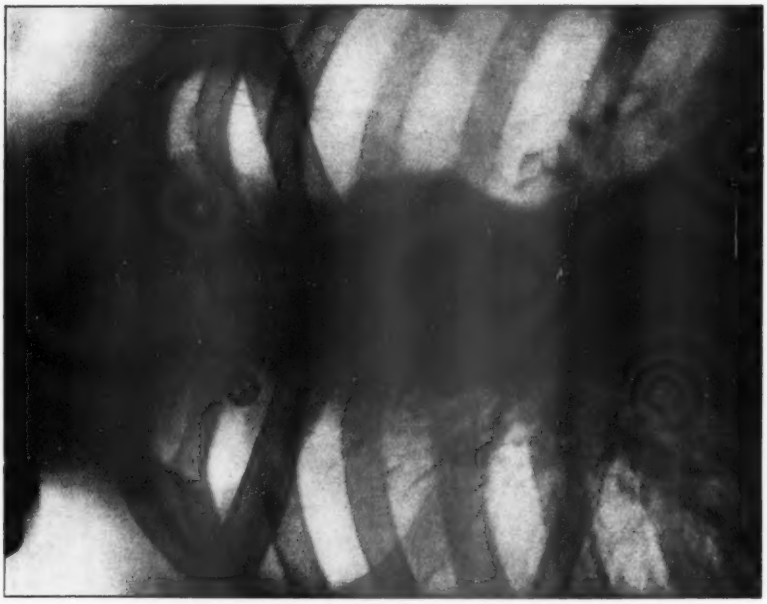

FIG. 12.—May 17, 1923.

Series: Figs. 9-13.

FIG. 15.

FIG. 14.

FIG. 14.—Secondary tumour in chest with enlarged glands on left side of neck. Pleural effusion left side of chest. Before X-ray and radium treatment. January 16, 1923.

FIG. 15.—Same patient February 13, 1926. Diminution of mediastinal tumour, fluid effusion on left side has cleared up, but there is a considerable collection on the right side. The primary growth was a tumour of the right testicle. Pathological report: "Spheroidal-celled carcinoma." A radiogram taken in 1926 showed the chest condition to be practically normal.

FIG. 17

From a patient suffering from sarcoma of the right breast, secondary growths in chest. A total failure of response to X-ray treatment.

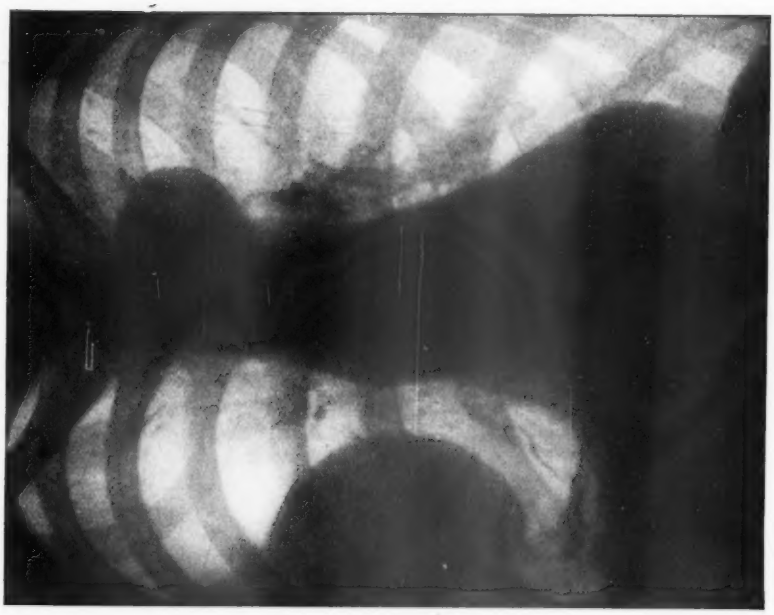

FIG. 16

Figs. 14 and 15. The next case is a very interesting one. It is that of a patient who had an operation for the removal of a testicle nine years ago. A pathologist described it as carcinoma. Prophylactic treatment was applied to the operation site and to the glands, and for two or three years he remained well. At the end of that time he developed a mass in the abdomen, which was regarded as a secondary tumour. This also was submitted to treatment, and cleared up; indeed, the response was so rapid that some doubt was expressed that it could have been malignant. Two years later still he again appeared with well-marked appearances of mediastinal tumour, and a group of glands on one side of the neck, very hard and indurated, with pleural effusion on the left side. That patient was submitted to radium treatment in the neck, in heavy doses, also in the mediastinum and with X-rays at the various ports of entry. The result was very satisfactory, as the effusion completely cleared, the mediastinal tumour diminished. But on the other side there was a large pleural effusion, with paralysis of the right side of the diaphragm, and for some time the patient was in great danger. The treatment was persisted in, and this effusion cleared up; there was recovery from the paralysis of the diaphragm, and three years after the completion of the treatment one could scarcely distinguish this chest from a normal one. The question of diagnosis also entered into this case, and from the radiological response I should ascribe the masses to lymphadenoma rather than carcinoma.

Figs. 16 and 17. The next figure is from a case in which I found a large mass on the right side, and a secondary mass above the level of the aorta. The patient had been operated on for sarcoma of the right breast some months previously, and when these masses were discovered, she was sent for treatment. The same treatment which would have cleared up a primary tumour and in some cases would have cleared up a secondary carcinomatous condition, was applied to this case, but without any benefit, indeed, it was probable that harm was done by the application, as the patient thereafter went rapidly downhill. Evidently the natural resistance of the body tissues had become exhausted, and the patient was no longer able to fight the condition. Yet here was a straightforward case which seemed simple in regard to treatment, and still no favourable response was obtained.

Dr. R. Hilton.

Artificial pneumothorax as an aid to diagnosis of intrathoracic tumour is particularly of use in cases in which there is pleural effusion, for this masks the X-ray picture. The injection of quite a small quantity of air will be sufficient to drop the fluid level and allow of a good radiogram. But the use of artificial pneumothorax is not limited to diagnosis but is also useful in some cases as the prelude to surgical intrapleural operation. Collapse of the lung removes it out of the way of the surgeon, and if performed slowly over a few days does not in most cases interfere with the oxygenation of the blood; whereas the sudden collapse of the lung within a quarter of an hour usually causes a severe anoxæmia.

It is certain that if a patient will not stand a slow, partial collapse from a small pneumothorax, he will be worse off if the lung is collapsed suddenly and completely by opening the chest wall.

The air should not be injected at positive pressure into the pleural cavity, but the sub-atmospheric pressure there should be allowed to draw in the air slowly.

Complete collapse should not be produced for diagnostic purposes or the shadow of the lung-stump may become too dense to be differentiated readily from tumour. Before operation, on the other hand, complete collapse (if possible) is advisable in some cases.

Sir Charlton Briscoe

said that he intended to deal with one diagnostic point only, a point which was found in a very considerable proportion of intrathoracic growths, namely, the signs of paralysis of one phrenic nerve. Signs leading to this diagnosis had been found in forty-one cases of intrathoracic lesions during the past three years; of these twenty-two were primary growths in the thorax; ten secondary; six were due to syphilis, including aneurysm, and three to tubercle. The phrenic nerve on the right side was

From a patient suffering from

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involved in thirty-one instances, and on the left in thirteen, both being involved in three cases. Of the thirteen left-sided cases the recurrent laryngeal had been involved in five cases.

The nerve had been obstructed (1) in the neck by enlarged glands, or by fibrous tissue resulting from repeated X-ray exposures for therapeutical purposes. It had also been involved (2) in the upper mediastinum. On the right side associated phenomena, resulting from pressure on the superior cava, had been found, and on the left side associated symptoms had arisen from involvement of the vagus, recurrent laryngeal, aorta and left bronchus, which were all near relations. (3) In the third part of the course of the nerve on the pericardium there were no neighbouring structures which gave rise to any clear symptoms, and in four cases in this series a diagnosis of a lesion in this situation had been made from the presence of the characteristic signs.

Experimentally, section of the phrenic nerve in a rabbit led to areas of deflation which were found at the margins of the lungs and diffusely scattered through the lower lobes. Similarly, paralysis of one phrenic nerve in man produced deflation in certain areas, which gave rise to signs which were part of the symptom complex on which the diagnosis was based.

To demonstrate these signs it was essential to make the physical examination with the patient as comfortable and quiet as possible, to insist on silence and to refrain from requiring deep breaths. (The speaker then showed charts of the areas of deficient pulmonary resonance, resulting from lesions of either phrenic nerve, and drew attention to the following points):—

(*a*) Lack of resonance in the neighbourhood of the manubrium. This had usually been attributed to the presence of secondary malignant glands, which, however, were rarely found. The lack of resonance was due to the fact that the deflated margin of the lung does not fill the pleura.

(*b*) The lack of normal pulmonary resonance at its lower part. Such resonance ended posteriorly at the level of the 7th or 8th rib in the scapula line on the side affected, anteriorly in the case of right phrenic paralysis, at the 4th rib instead of the 6th.

(*c*) Similarly, the cardiac dullness was apparently increased to the right, or to the left (in the case of left phrenic paralysis), giving rise to the impression that the heart was displaced laterally. This deduction could be corrected by X-ray examination, and the time of the pulsation, which, when present to the right of the sternum, could be shown to be auricular.

These areas of deficient resonance were diminished by several deep breaths, but were again found when quiet breathing was resumed.

Subsidiary points for the diagnosis of the condition were the following: (1) The alteration of the position of the liver. (2) Relative increase of thoracic movement in quiet respiration. (3) Defective epigastric propulsion—either an unnaturally small amount of propulsion, or a wavy movement lacking force, or even respiratory recession.

He (Sir Charlton Briscoe) suggested that the cases of massive effusion in which the diaphragm might be bulged convexly downwards, were associated with paralysis of the phrenic nerve on that side, this condition having been found in three of the cases of this series. In these cases aspiration, combined with the production of artificial pneumothorax, gave relief. The sensation of weight in the chest was removed, and successive aspirations were required at longer intervals, four to six weeks instead of seven to ten days.

He pointed out the following difficulties in the X-ray examination of patients with unilateral paralysis: (1) Deflated lung tended to become opaque and cloud the upper border of the diaphragm. (2) Small amounts of pleural effusion were often present. (3) The affected half of the diaphragm was not necessarily raised. (4) There

was a certain excursion probably due to traction of the sound side. (5) When the individual was asked to breathe deeply this resulted in a thoracic movement with very little diaphragmatic depression.

In his (the speaker's) opinion the best method was to observe and take a tracing on the screen of the contour of the two halves of the diaphragm in quiet breathing, and in deep breathing,—such deep breathing being produced in answer to the instruction: "Push out your stomach!" An asynchronous movement of the two halves was characteristic, as was also a displacement of the mediastinal contents from the paralysed side at the end of inspiration.

In conclusion, attention was drawn to the large number of cases in which this sign occurred, and to its importance as a diagnostic phenomenon.

Dr. F. G. CHANDLER.

My remarks will deal first with differential diagnosis and secondly with treatment.

Since the publication of Jacobaeus' paper many of us have been eager to discover innocent tumours of the chest. If they are to be diagnosed early it will mean their accidental discovery, for they give rise to few or no symptoms in the early stages. Routine X-ray examination of all chest cases is very desirable. This one can do at hospital, but in private practice it will be difficult until such examination becomes much less expensive than it is at the present time. In those few cases of innocent intrathoracic tumour that I have seen and in those that I have read about I have not found that greatly enlarged veins over the chest and abdomen occur, with the exception of mediastinal thyroids. If, therefore, very large veins are present *and have existed for many years*, the probability is, I would tentatively suggest, that the condition is aneurysm, mediastinal thyroid or gumma.

A little over a month ago there came to my out-patients' clinic at Charing Cross Hospital a man, aged 46, whose case I will briefly describe:—

The morning before he came to hospital he had awakened to find his left leg had "gone dead." On examination I found enormous veins in his right arm and neck and over his chest and abdomen, the blood flowing from above downwards. He declared that they had been present for eight years. He had previously attended one or two hospitals. Aneurysm and the possibility of an innocent tumour, in spite of what I have just said, suggested themselves as causes. Immediate screening and the X-ray picture, however, suggested neither of these conditions. There was a previous history of venereal disease. The Wassermann test proved strongly positive. After admission he rapidly developed a complete left hemiplegia and died. Post-mortem examination showed a large gumma in which spirochætes were demonstrable, compressing the great veins of the superior mediastinum. There was a gumma in the meninges and a cerebral abscess of obscure origin.

Now though I have for years been on the look-out for cases of syphilis of the lung or mediastinum other than aneurysm and its secondary pressure effects, this is one of the very few cases (three in all) that I have ever seen in which I could prove to my satisfaction that the condition was truly syphilitic. I believe the condition to be very rare, but the possibility of its existence must not be overlooked; for if treated early it can be cured. The diagnosis between innocent and malignant growth is of fascinating interest, but this has already been carefully dealt with.

As regards treatment I would confine my remarks to primary sarcoma.

Twelve years ago I saw a small boy, aged 13, greatly wasted, who had two lumps on the right side of his chest, a network of very large veins over his right chest and abdomen, whose apex beat was displaced to the left axilla, and whose chest on the right side was stony dull to percussion, with absent breath sounds and vocal resonance. He underwent X-ray treatment by what were called massive doses in those days but which in intensity and penetration, I take it, are not comparable to those given to-day. After six doses the lumps and the large veins

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disappeared entirely. He went out of hospital to a convalescent home feeling and looking well. Almost exactly a year later he returned to hospital and died, when sarcoma of the mediastinum involving lung and pericardium was found at the post-mortem examination.

Since that time I have seen a very large number of cases of mediastinal sarcoma, I have never seen the slightest amelioration of the condition from X-ray treatment, and I begin to wonder whether we are justified in advising the treatment at all. Indeed, I have seen patients rendered more ill and more miserable by it. I am certain that if an appreciable ameliorating effect is not obtained after three applications of the rays, the treatment should not be continued.

It may be useful to enumerate those measures which I have personally tried in these cases. X-ray treatment, radium implantation in the tumour, emetine injections, salvarsan, tincture of violets, large doses of potassium iodide ; and I have been able to observe cases treated by huge doses of Coley's fluid and by that ludicrous fraud, Abram's box, all without any beneficial effect. If we could diagnose these cases early, surgery and radium implantation would be the most rational treatment, for it is remarkable how many cases of mediastinal sarcoma appear to follow their course without giving rise to metastases. Apart from this the only treatment is palliative, and of this I think the best is the gradual accustoming the patient to opium and the free use of cocaine.

Dr. Hugh Thursfield (Chairman)

said that several speakers had remarked that these growths appeared to be becoming more common ; but one point which seemed not to have been considered was that the total admissions to the large London hospitals had nearly doubled in 1925 as compared with 1907. Cases were now turned out of hospital much more rapidly. A second point was that, since 1907, there had been considerable classes of cases removed from the wards of general hospitals, particularly tuberculosis cases, and, as a result, there were now being taken into the general hospitals, cases which, in the days when he was a resident, had to be sent to the infirmary. The consequence was that the desperate carcinoma cases such as had been described in this discussion were now freely admitted into the ordinary hospitals. He doubted whether there was now a real increase in the number of the cases under discussion.

Dr. F. E. Saxby Willis.

In considering the problem of the early diagnosis of intrathoracic new growths as they present themselves to the physician in the first place, it appears that sufficient emphasis has not been given to the purely clinical manifestations.

The malignant primary growths fall into three main groups: (1) Carcinoma of the bronchi ; (2) carcinoma of the lung; (3) those originating in the mediastinum (mainly sarcomata).

The first group would appear in the early stages to give rise chiefly to cough and hæmoptysis, with gradually increasing dyspnœa. As regards the physical signs, a pleural effusion is often suggested, but upon thoracocentesis being carried out, fluid would appear to be the exception. As an illustration of the latter point I refer to a case shown before the Clinical Section,[1] with later report of pathological findings supplied by Dr. W. A. Young.[2]

In this case, both the physical signs and X-ray examination suggested at first a left-sided pleural effusion, but the main symptoms were cough, red-currant jelly sputum and dyspnœa. No fluid was present in the pleura and the signs were accounted for by massive collapse of the left lower lobe, due to the obstructed bronchus.

[1] *Proceedings*, 1924-25, xviii (Clin. Sect.), pp. 21, 22.
[2] *Ibid.*, 1926, xix (Clin. Sect.), pp. 15-16.

A section through the root of the lung and the heart and pericardium, showing the growth originating in the bronchus and extending into the pericardium, is shown to-night.

In the second group, pain due to early pleural involvement is usually marked, so also is dyspnœa, while cough is not such a prominent feature and is only accompanied by hæmoptysis in the later stages.

In the third group, the earliest and most prominent symptom is dyspnœa. Pain is marked where the growth is large enough to press on the nerve roots, and pressure on the phrenic nerve may cause paralysis of the diaphragm on one side. Cough has not been an early symptom in my experience of this group.

An example of this group is a case in which the early symptom was dyspnœa, quite out of proportion to a small pleural effusion which was present. The first radiogram shows no evidence of a new growth, but a second taken six weeks later shows a rounded shadow to the right of the manubrium. Lateral views, as well as the physical signs, suggested that the main mass was situated posteriorly, and Mr. George Waugh therefore chose the posterior thoracic route in exploring. An excellent exposure was obtained, but the growth was found to be too much in relation to the arch of the aorta for any attempt at removal. A gland excised proved to be of sarcomatous nature. The patient stood the operation well.

It would appear justifiable to explore these cases more frequently and earlier than has hitherto been the common practice, even when situated in the posterior mediastinum.

Dr. Hugh Thursfield (Chairman)

said he was surprised that more importance had not been attached by speakers to early dyspnœa in these cases, or in many of them. Patients might not voluntarily complain of it, and frequently only when asked a leading question did they own to it; but even so, however elicited, it was a more valuable sign than the speakers seemed to regard it, or had led their hearers to suppose.

Another point, to which Sir Charlton Briscoe had particularly alluded, consisted in the extraordinary importance of the physician himself inspecting the screening of these cases and not resting content with a mere examination of the finished X-ray plate. He was speaking of a general principle, not out of a wealth of personal experience, for he had not seen very many of these cases. He regarded this as so important that in a doubtful case he absolutely ignored the X-ray plate until he had viewed the patient with the fluorescent screen. With the latter, one could turn the patient about and adjust him to different view-points, and generally convince oneself in a way which it was impossible to do merely with the plates. A further point in this regard was that, when trusting to the plate alone, one was almost entirely in the hands of the radiologist and his interpretation; the clinician could not check him, and yet the radiologist required to be checked just as much as the physician.

Mr. J. E. H. Roberts (in reply)

said he quite agreed with Dr. Hilton that a preliminary artificial pneumothorax was an advantage to the surgeon before his operation, and this in addition to its diagnostic value.

Dr. Chandler asked if anyone had seen large veins on the surface of the chest in a case of innocent growth of the thorax. He (the speaker) had seen enlarged veins in such a case, but not greatly enlarged veins.

He fully agreed that every form of investigation must be brought into play in solving many cases, and even then the diagnosis was not clear. He was surprised to note the absence in the discussion of a reference to hydatid cyst!

With regard to the X-ray side of the work, diagnosis was impossible without it at the present day. But a point in this connexion which had not been mentioned was that, in certain cases of apparently innocent tumour, X-rays were used at intervals of time in order to determine whether the tumour was increasing in size. These measurements were not of much value unless the centering and distancing of the tube were the same on each occasion.

Dr. STANLEY MELVILLE (in reply)

said that with regard to the Chairman's remark concerning the physician himself seeing the screening of his cases, he (the speaker) was grateful that a physician of Dr. Thursfield's standing was ready to break down one of the unfortunate water-tight compartments in which at present the radiologist worked. The radiologist heartily welcomed the physician's co-operation, and his own practice was rendered easier when the physician came and looked for himself; it was a most vital thing to do. If all physicians took up the same attitude as did Dr. Thursfield on this matter, the diagnosis of these conditions would be much more frequently made.